

INTRODUCTION

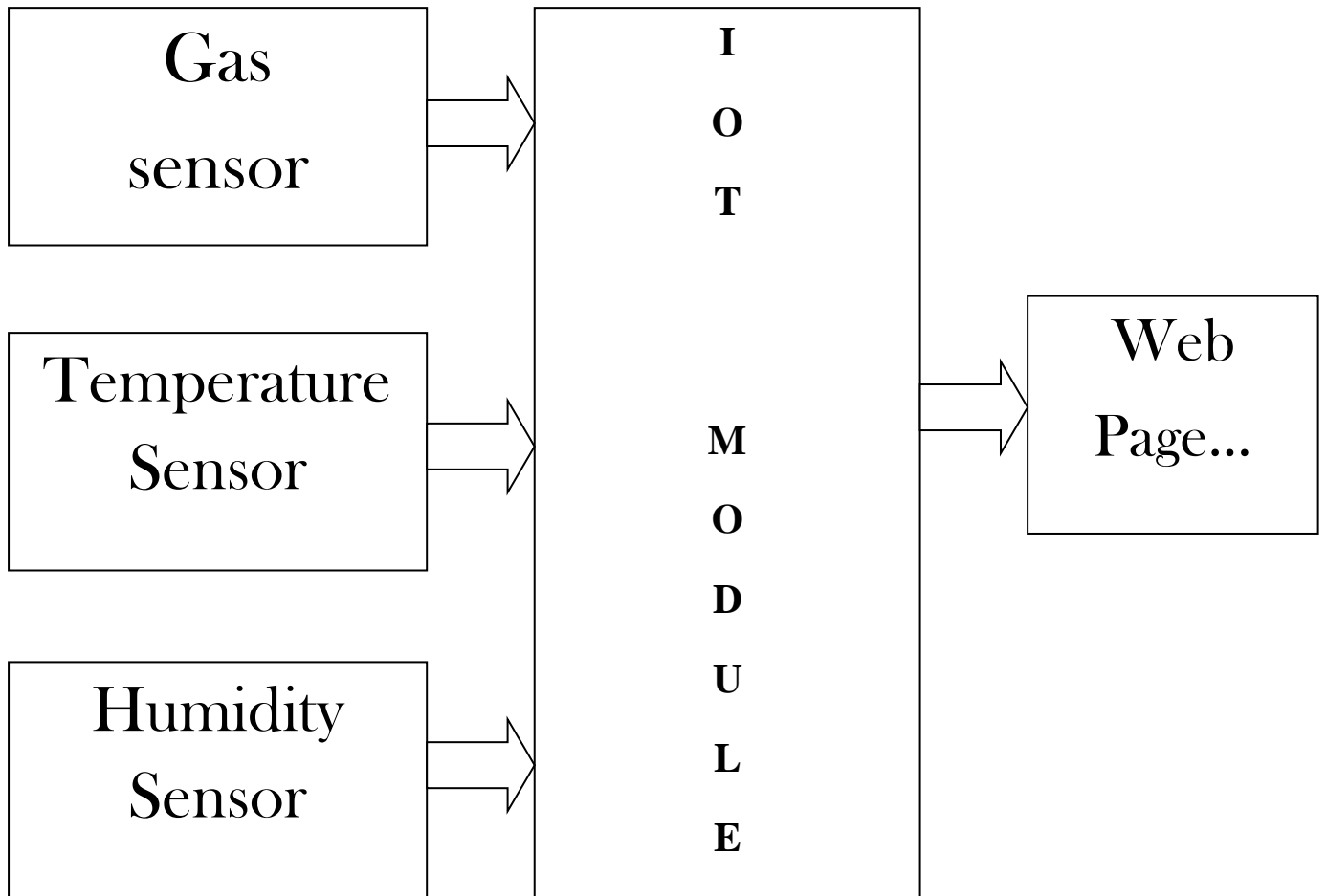
Introduction:

Mining is indispensable to the creation of goods, infrastructure and services which enhance the quality of their lives. As a society we're blessed to enjoy the many advantages that industry manufactured products provide us by processing these raw materials.

Working in the earth presents many different security and health dangers. Frequently the underground environment is shaky or unpleasant. The mines that are deeper, the more dangerous it could be to be running jobs. There's oxygen leak that is restricted, and there are challenges related to leaving a mine if a crisis happen.

So here we propose a mining tracking as well as safety system for the mining industry using microcontroller based circuit on the worker helmet. We use rf based circuitry to detect workers moving through the entire mining site. The helmet is integrated with an rf based tracking system which in coordination with the tracker rf systems help provide data over IOT. The system makes use of atmega microcontroller based rf tracker circuitry to receive the data transmitted by worker helmet nodes. This helps map the current location of workers through the entire mining site. Moreover each worker helmet circuit is integrated with a panic/emergency button. This button when pressed shows an emergency sign over the IOT web interface about the worker emergency. This can be used for any emergencies like – toxic gas inhalation, cave ins, physical injury etc. Thus the system ensures mining worker safety using IOT.

BLOCK DIAGRAM



BLOCK DIAGRAM DESCRIPTION

ESP8266:

Espressif Systems' Smart Connectivity Platform (ESCP) of high performance wireless SOCs, for mobile platform designers, provides unsurpassed ability to embed Wi-Fi capabilities within other systems, at the lowest cost with the greatest functionality.

Humidity Sensor :

They consist of a humidity sensing component, a NTC temperature sensor (or thermistor) and an IC on the back side of the sensor. They are very cheap but still providing great performance. The sampling rate for the DHT11 is 1Hz or one reading every second. The operating voltage of sensor is from 3 to 5 volts, while the max current used when measuring is 2.5mA

Temperature Sensor :

These types of temperature sensor vary from simple ON/OFF thermostatic devices which control a domestic hot water heating system to highly sensitive semiconductor types that can control complex process control furnace plants.

We remember from our school science classes that the movement of molecules and atoms produces heat (kinetic energy) and the greater the movement, the more heat that is generated. **Temperature Sensors** measure the amount of heat energy or even coldness that is generated by an object or system, allowing us to "sense" or detect any physical change to that temperature producing either an analogue or digital output.

Gas Sensor :

A gas detector is a device that detects the presence of gases in an area, often as part of a safety system. This type of equipment is used to detect a gas leak or other emissions and can interface with a control system so a process can be automatically shut down. A gas detector can sound an alarm to operators in the area where the leak is occurring, giving them the opportunity to leave. This type of device is important because there are many gases that can be harmful to organic life, such as humans or animals.

gases, and oxygen depletion. This type of device is used widely in industry and can be found in locations, such as on oil rigs, to monitor manufacture processes and emerging technologies such as photovoltaic. They may be used in firefighting.

CIRCUIT DIAGRAM

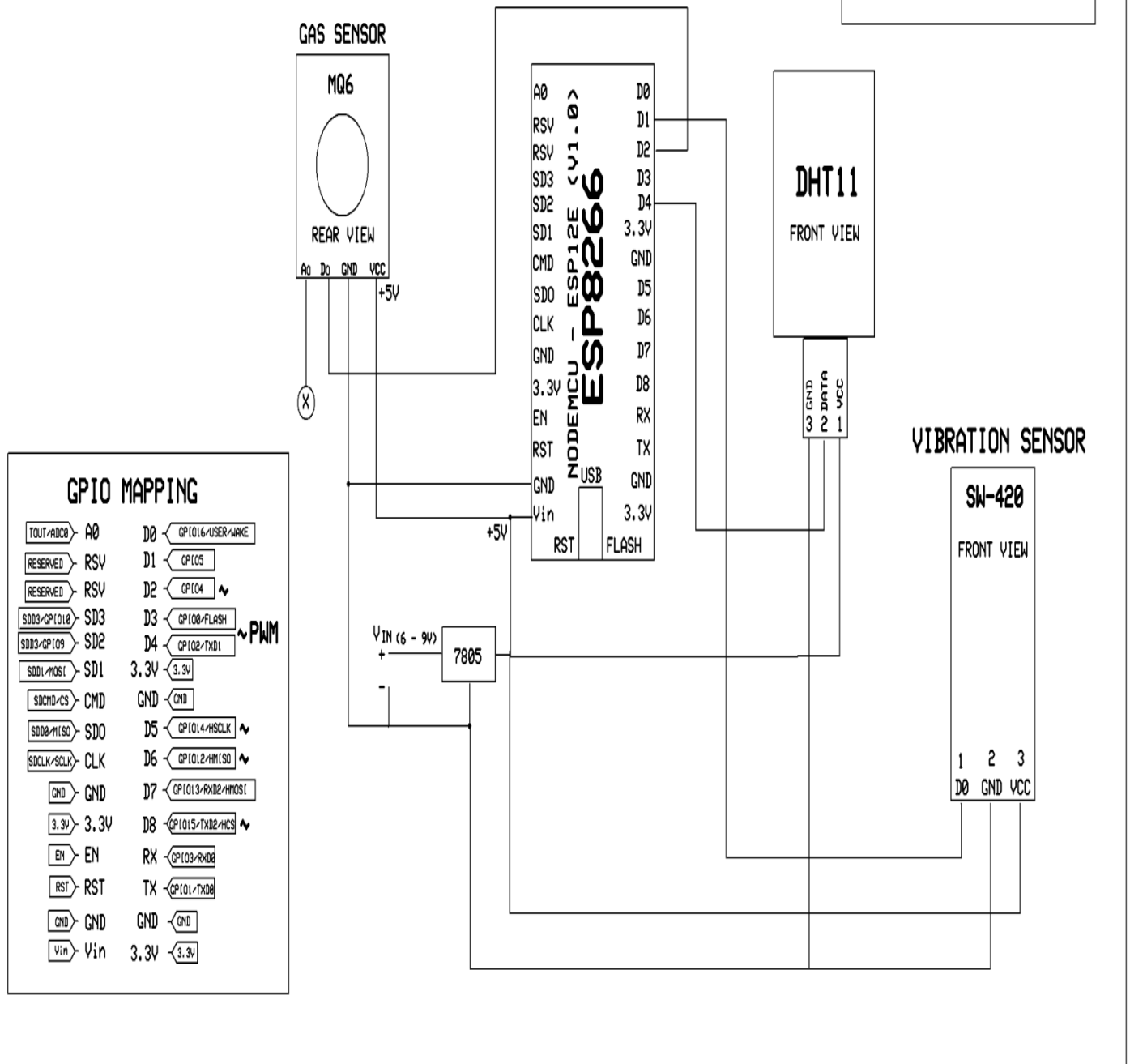
CIRCUIT DIAGRAM :

SMART HELMET FOR MINERS

DHT11 PIN 2--> D4

GAS SENSOR PIN 3--> D2

VIBRATION SENSOR PIN 1--> D1



CIRCUIT DIAGRAM DESCRIPTION

ESP8266 :

ESP8266 on-board processing and storage capabilities allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. With its high degree of on-chip integration, which includes the antenna switch balun, power management converters, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

Sophisticated system-level features include fast sleep/wake context switching for energy-efficient VoIP, adaptive radio biasing for low-power operation, advance signal processing, and spur cancellation and radio co-existence features for common cellular, Bluetooth, DDR, LVDS, LCD interference mitigation.

MQ-5 :

MQ-5 gas sensor applies SnO₂ which has a lower conductivity in the clear air as a gas-sensing material. In an atmosphere where there may be inflammable gases, the conductivity of the gas sensor raises along with the inflammable gas concentration increases. MQ-5 plays a high performance in detecting butane, propane and methane, and can identify both propane and methane at a same time. MQ-5 is highly sensitive to natural gas. It features with the ability to detect various inflammable gases and lower cost, making it an ideal choice of different applications of gas detection.

DTH 11:

This DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.

Each DHT11 element is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as programmes in the OTP memory, which are used by the sensor's internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package. It is convenient to connect and special packages can be provided according to users' request.

VIBRATION SENSOR :

This module features an adjustable potentiometer, a vibration sensor, and a LM393 comparator chip to give an adjustable digital output based on the amount of vibration. The potentiometer can be adjusted to both increase and decrease the sensitivity to the desired amount. The module outputs a logic level high (VCC) when it is triggered and a low (GND) when it isn't. Additionally there is an onboard LED that turns on when the module is triggered. Many Applications can be created by measuring Vibration level, but sensing vibration accurately is a difficult job. This article describes about vibration sensor SW-420 and Arduino interface then it may help you to design effort less vibration measurement. The vibration sensor SW-420 Comes with breakout board that includes comparator LM 393 and Adjustable on board potentiometer for sensitivity threshold selection, and signal indication LED.

REGULATOR :

A regulated power supply is very much essential for several electronic devices due to the semiconductor material employed in them have a fixed rate of current as well as voltage. The device may get damaged if there is any deviation from the fixed rate. It is an IC in the 78XX family of linear voltage regulators that produce a regulated 5V as output. IC 7805 is a three terminal linear voltage regulator IC with a fixed output voltage of 5V which is useful in a wide range of applications. Some of the important features of the 7805 IC are as follows:

- It can deliver up to 1.5 A of current (with heat sink).
- Has both internal current limiting and thermal shutdown features.
- Requires very minimum external components to fully function.

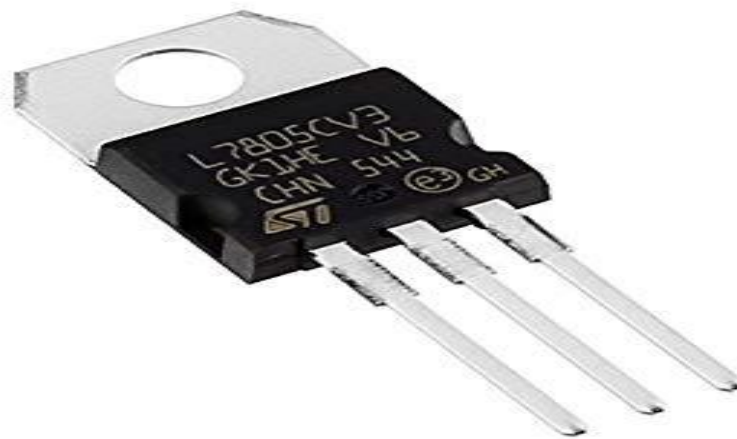


Fig .4 Regulator

HARDWARE

DETAILS

HARD WARE DETAILS

ESP8266 :

Espressif Systems' Smart Connectivity Platform (ESCP) of high performance wireless SOCs, for mobile platform designers, provides unsurpassed ability to embed Wi-Fi capabilities within other systems, at the lowest cost with the greatest functionality.

Features of ESP8266:

- 802.11 b/g/n protocol
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Integrated TR switch, balun, LNA, power amplifier and matching network
- Integrated PLL, regulators, and power management units
- +19.5dBm output power in 802.11b mode
- Integrated temperature sensor
- Supports antenna diversity
- Power down leakage current of < 10uA
- Integrated low power 32-bit CPU could be used as application processor
- SDIO 2.0, SPI, UART
- STBC, 1×1 MIMO, 2×1 MIMO
- A-MPDU & A-MSDU aggregation & 0.4μs guard interval
- Wake up and transmit packets in < 2ms
- Standby power consumption of < 1.0mW (DTIM3)

Description:

ESP8266 offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor.

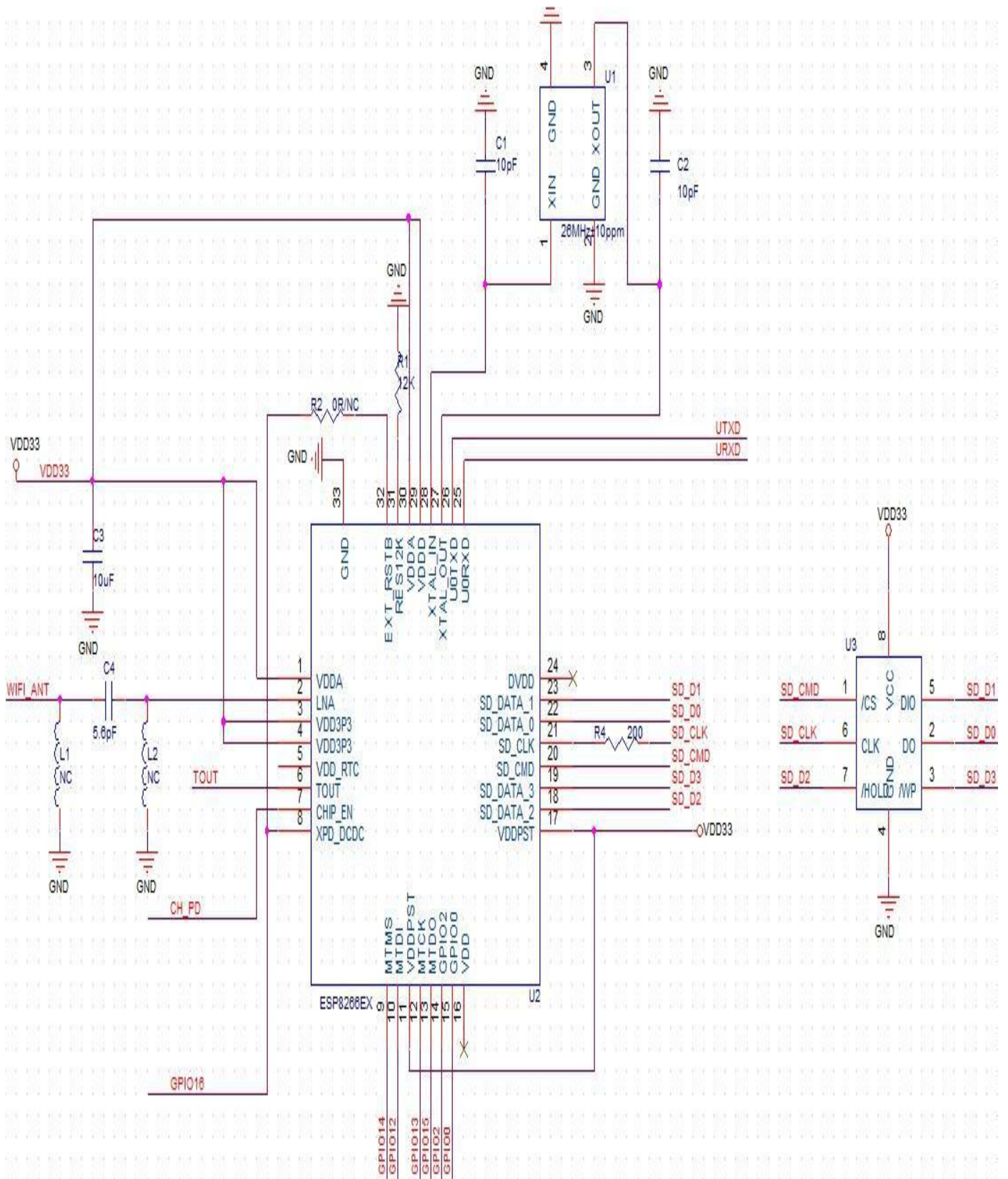
When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements.

Alternately, serving as a Wi-Fi adapter, wireless internet access can be added to any microcontroller-based design with simple connectivity through UART interface or the CPU AHB bridge interface.

ESP8266 on-board processing and storage capabilities allow it to be integrated with the sensors and other application specific devices through its GPIOs with minimal development up-front and minimal loading during runtime. With its high degree of on-chip integration, which includes the antenna switch balun, power management converters, it requires minimal external circuitry, and the entire solution, including front-end module, is designed to occupy minimal PCB area.

Sophisticated system-level features include fast sleep/wake context switching for energy-efficient VoIP, adaptive radio biasing for low-power operation, advance signal processing, and spur cancellation and radio co-existence features for common cellular, Bluetooth, DDR, LVDS, LCD interference mitigation.

ESP8266EX schematic diagram:



ESP8266 Applications

- Smart power plugs
- Home automation
- Mesh network
- Industrial wireless control
- Baby monitors
- IP Cameras
- Sensor networks
- Wearable electronics
- Wi-Fi location-aware devices
- Security ID tags
- Wi-Fi position system beacons

Specifications:

Current Consumption

The following current consumption is based on 3.3V supply, and 25 °C ambient, using internal regulators. Measurements are done at antenna port without SAW filter. All the transmitter's measurements are based on 90% duty cycle, continuous transmit mode

Mode	Min	Type	Max	Unit
Transmit 802.11b, CCK 1Mbps, P _{OUT} =+19.5dBm		215		mA
Transmit 802.11b, CCK 11Mbps, P _{OUT} =+18.5dBm		197		mA
Transmit 802.11g, OFDM 54Mbps, P _{OUT} =+16dBm		145		mA
Transmit 802.11n, MCS7, P _{OUT} =+14dBm		135		mA
Receive 802.11b, packet length=1024 byte, -80dBm		60		mA
Receive 802.11g, packet length=1024 byte, -70dBm		60		mA
Receive 802.11n, packet length=1024 byte, -65dBm		62		mA
Standby		0.9		mA
Deep sleep		10		uA
Power save mode DTIM 1		1.2		mA

Power save mode DTIM 3		0.86		mA
Total shutdown		0.5		uA

RF Performance

The following are measured under room temperature conditions with 3.3V and 1.1V power supplies.

Description	Min	Typical	Max	Unit
Input frequency	2412		2484	MHz
Input impedance		50		Ω
Input reflection			-10	dB
Output power of PA for 72.2Mbps	14	15	16	dBm
Output power of PA for 11b mode	17.5	18.5	19.5	dBm
Sensitivity				
CCK, 1Mbps		-98		dBm
CCK, 11Mbps		-91		dBm
6Mbps (1/2 BPSK)		-93		dBm
54Mbps (3/4 64-QAM)		-75		dBm

HT20, MCS7 (65Mbps, 72.2Mbps)		-71		dBm
Adjacent Channel Rejection				
OFDM, 6Mbps		37		dB
OFDM, 54Mbps		21		dB
HT20, MCS0		37		dB
HT20, MCS7		20		dB

CPU, Memory and Interfaces

CPU

This chip embeds an ultra low power Micro 32-bit CPU, with 16-bit thumb mode. This CPU can be interfaced using:

- code RAM/ROM interface (iBus) that goes to the memory controller, that can also be used to access external flash memory,
- data RAM interface (dBus), that also goes to the memory controller
- AHB interface, for register access, and
- JTAG interface for debugging

Memory Controller

The memory controller contains ROM, and SRAM. It is accessed by the CPU using the iBus, dBus and AHB interface. Any of these interfaces can request access to the ROM or RAM modules, and the memory controller arbiters serve these 3 interfaces on a first-come-first-serve basis.

AHB and AHB Blocks

The AHB blocks performs the function of an arbiter, controls the AHB interfaces from the MAC, SDIO (host) and CPU. Depending on the address, the AHB data requests can go into one of the two slaves:

- APB block, or
- flash controller (usually for standalone applications).

Data requests to the memory controller are usually high speed requests, and requests to the APB block are usually register access. The APB block acts as a decoder. It is meant only for access to programmable registers within ESP8266's main blocks. Depending on the address, the APB request can go to the radio, SI/SPI, SDIO (host), GPIO, UART, real-time clock (RTC), MAC or digital baseband.

Interfaces

The ESP8266 contains several analog and digital interfaces described in the following sections.

Master SI / SPI Control (Optional)

The master serial interface (SI) can operate in two, three or four-wire bus configurations to control the EEPROM or other I2C/SPI devices. Multiple I2C devices with different device addresses are supported by sharing the 2-wire bus.

Multiple SPI devices are supported by sharing the clock and data signals, using separate software controlled GPIO pins as chip selects.

The SPI can be used for controlling external devices such as serial flash memories, audio CODECs, or other slave devices. It is set up as a standard master SPI device with 3 different enable pins:

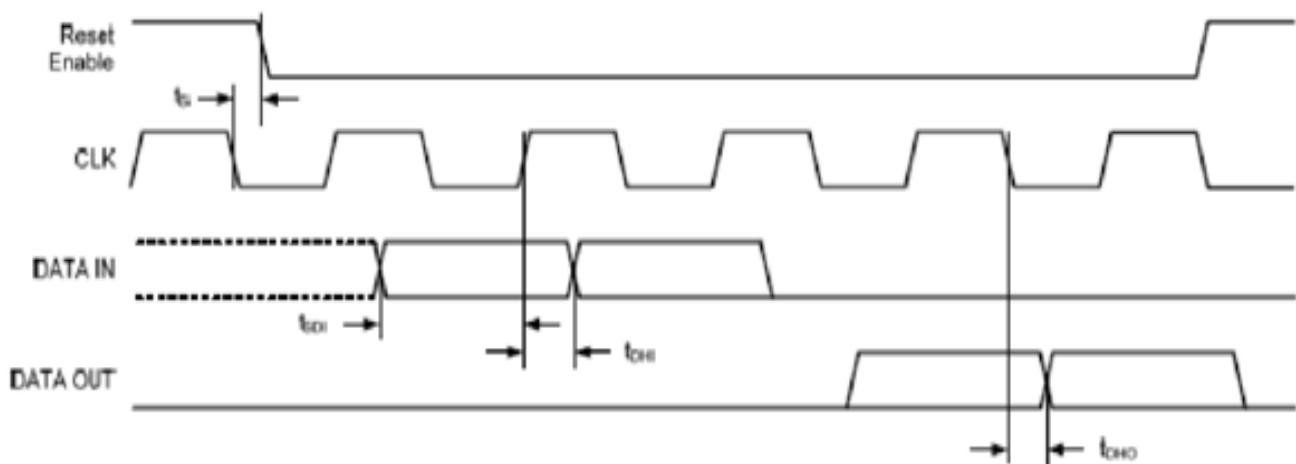
- SPI_EN0,
- SPI_EN1,
- SPI_EN2.

Both SPI master and SPI slave are supported with the latter being used as a host interface.

SPI_EN0 is used as an enable signal to an external serial flash memory for downloading patch code and/or MIB-data to the baseband in an embedded application. In a host based application, patch code and MIB-data can alternatively be downloaded via the host interface. This pin is active low and should be left open if not used.

SPI_EN1 is usually used for a user application, e.g. to control an external audio codec or sensor ADC, in an embedded application. This pin is active low and should be left open if not used.

MIB information, MAC address, and calibration data, or for general use. This pin is active low and should be left open if not used.



Spi timing characteristics

General Purpose IO

There are up to 16 GPIO pins. They can be assigned to various functions by the firmware. Each GPIO can be configured with internal pull-up/down, input available for sampling by a software register, input triggering an edge or level CPU interrupt, input triggering a level wakeup interrupt, open-drain or push-pull output driver, or output source from a software register, or a sigma-delta PWM DAC.

These pins are multiplexed with other functions such as host interface, UART, SI, Bluetooth coexistence, etc.

SPI_EN2 usually controls an EEPROM to store individual data, such as

Digital IO Pads

The digital IO pads are bidirectional, non-inverting and tri-state. It includes input and an output buffer with tristate control inputs. Besides this, for low power operations, the IO can also be set to hold. For instance, when we power down the chip, all output enable signals can be set to hold

Optional hold functionality can be built into the IO if requested. When the IO is not driven by the internal or external circuitry, the hold functionality can be used to hold the state to the last used state.

The hold functionality introduces some positive feedback into the pad. Hence, the external driver that drives the pad must be stronger than the positive feedback. The required drive strength is however small – in the range of

Parameter	Symbol	Min	Max	Unit
Input low voltage	VIL	-0.3	$0.25 \times V_{IO}$	V
Input high voltage	VIH	$0.75 \times V_{IO}$	3.6	V
Input leakage current	IIL		50	nA
Output low voltage	VOL		$0.1 \times V_{IO}$	V
Output high voltage	VOH	$0.8 \times V_{IO}$		V
Input pin capacitance	Cpad		2	pF
VDDIO	VIO	1.7	3.6	V
Maximum drive capability	IMAX		12	mA
Temperature	Tamb	-20	100	°C

All digital IO pins are protected from over-voltage with a snap-back circuit connected between the pad and ground. The snap back voltage is typically about 6V, and the holding voltage is 5.8V. This provides protection from over-voltages and ESD. The output devices are also protected from reversed voltages with diodes.

Firmware & Software Development Kit

The application and firmware is executed in on-chip ROM and SRAM, which loads the instructions during wake-up, through the SDIO interface, from the external flash.

The firmware implements TCP/IP, the full 802.11 b/g/n/e/i WLAN MAC protocol and Wi-Fi Direct specification. It supports not only basic service set (BSS) operations under the distributed control function (DCF) but also P2P group operation compliant with the latest Wi-Fi P2P protocol. Low level protocol functions are handled automatically by ESP8266:

- RTS/CTS,
- acknowledgement,
- fragmentation and defragmentation,
- aggregation,
- frame encapsulation (802.11h/RFC 1042),
- automatic beacon monitoring / scanning, and
- P2P Wi-Fi direct,

Passive or active scanning, as well as P2P discovery procedure is performed autonomously once initiated by the appropriate command. Power management is handled with minimum host interaction to minimize active duty period.

Features

The SDK includes the following library functions:

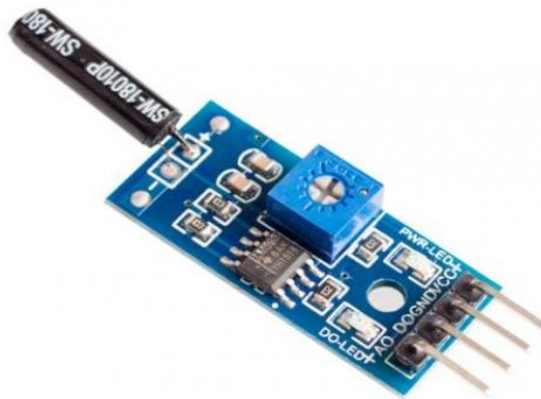
- 802.11 b/g/n/d/e/i/k/r support;
- Wi-Fi Direct (P2P) support:
- P2P Discovery, P2P Group Owner mode, P2P Power Management

- Infrastructure BSS Station mode / P2P mode / softAP mode support;
- Hardware accelerators for CCMP (CBC-MAC, counter mode), TKIP (MIC, RC4), WAPI (SMS4), WEP (RC4), CRC
 - WPA/WPA2 PSK, and WPS driver;
- Additional 802.11i security features such as pre-authentication, and TSN;
- Open Interface for various upper layer authentication schemes over EAP such as TLS, PEAP, LEAP, SIM, AKA, or customer specific;
- 802.11n support (2.4GHz / 5GHz);
- Supports MIMO 1×1 and 2×1, STBC, A-MPDU and A-MSDU aggregation and 0.4μs guard interval;
- WMM power save U-APSD;
- Multiple queue management to fully utilize traffic prioritization defined by 802.11e standard;
- UMA compliant and certified;
- 802.11h/RFC1042 frame encapsulation;
- Scattered DMA for optimal CPU off load on Zero Copy data transfer operations;
- Antenna diversity and selection (software managed hardware);
- Clock/power gating combined with 802.11-compliant power management dynamically adapted to current connection condition providing minimal power consumption;
- Adaptive rate fallback algorithm sets the optimum transmission rate and Tx power based on actual SNR and packet loss information;
- Automatic retransmission and response on MAC to avoid packet discarding on slow host environment;
- Seamless roaming support;
- Configurable packet traffic arbitration (PTA) with dedicated slave processor based design provides flexible and exact timing Bluetooth co-existence support for a wide range of Bluetooth Chip vendors;

Dual and single antenna Bluetooth co-existence support with optional simultaneous receive (Wi-Fi/Bluetooth) capability

VIBRATION SENSOR :

This module features an adjustable potentiometer, a vibration sensor, and a LM393 comparator chip to give an adjustable digital output based on the amount of vibration. The potentiometer can be adjusted to both increase and decrease the sensitivity to the desired amount. The module outputs a logic level high (VCC) when it is triggered and a low (GND) **when it isn't. Additionally** there is an onboard LED that turns on when the module is triggered.

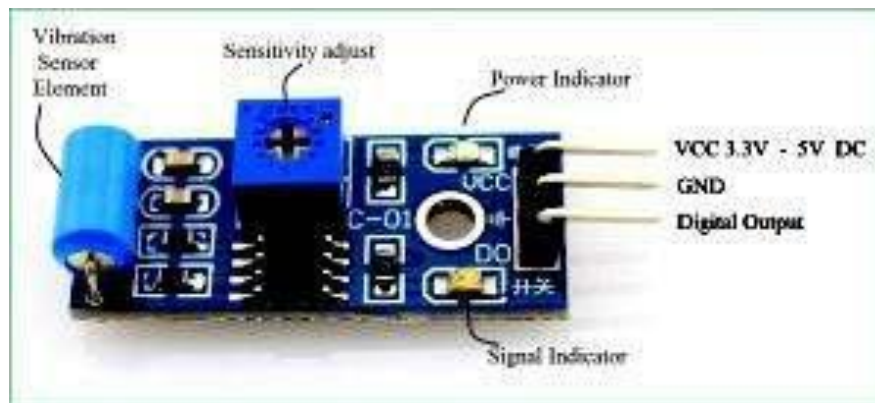


Features:

- The default state of the switch is close
- Digital output Supply voltage:3.3V-5V
- On-board indicator LED to show the results
- On-board LM393 chip
- SW-420 based sensor, normally closed type vibration sensor
- Dimension of the board: 3.2cm x 1.4cm

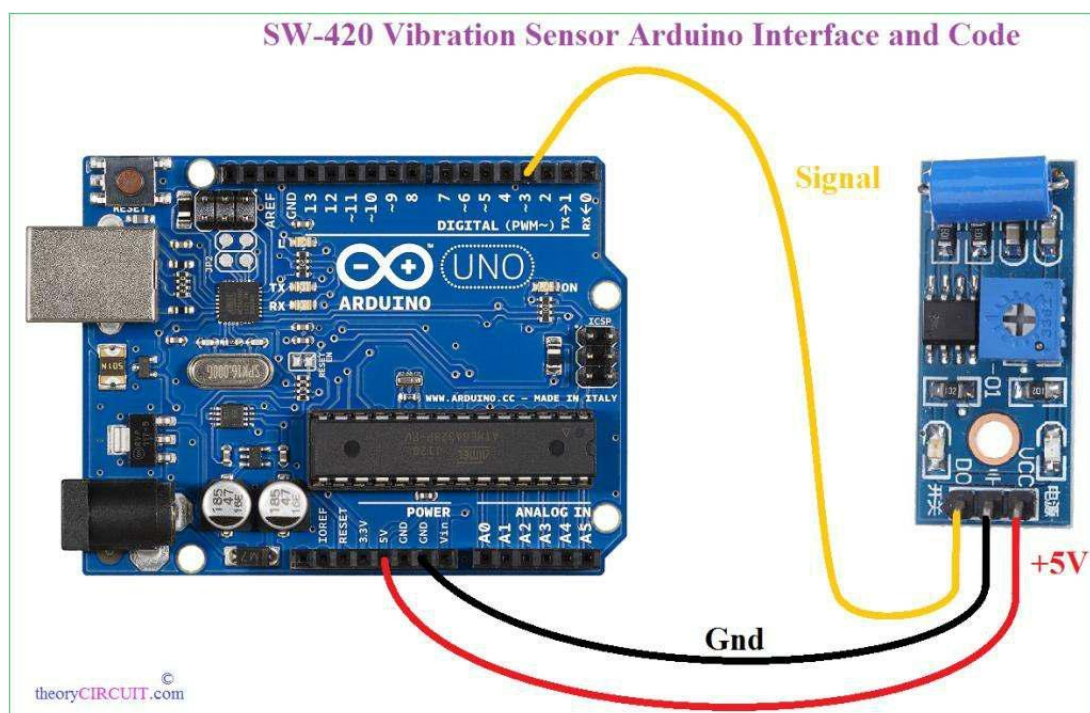
Many Applications can created by measuring Vibration level, but sensing vibration accurately is a difficult job. This article describes about vibration sensor SW-420 and Arduino interface then it may help you to design effort less vibration measurement.

The vibration sensor SW-420 Comes with breakout board that includes comparator LM 393 and Adjustable on board potentiometer for sensitivity threshold selection, and signal indication LED.



This sensor module produce logic states depends on vibration and external force applied on it. When there is no vibration this module gives logic LOW output. When it feels vibration then output of this module goes to logic HIGH. The working bias of this circuit is between 3.3V to 5V DC.

Arduino Hookup with SW-420:



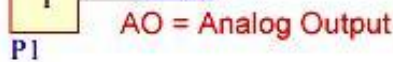
Connect Vcc pin of sensor board to 5V pin of Arduino board, connect Gnd pin to Gnd pin of Arduino, Connect DO output signal pin of sensor board to Arduino digital pin D3. Do some calibration and adjust the sensitivity threshold, then upload the following sketch to Arduino board.

Arduino Code for Logic State Output from sensor module, here onboard LED of Arduino indicates the presence of vibration.

Application Ideas :

- Vibration detecting
- Burglary protection system
- Object Movement detecting
- Triggering effect reported theft alarm
- Smart car
- Earthquake alarm
- Motorcycle alarm

•



-
- Page**

30

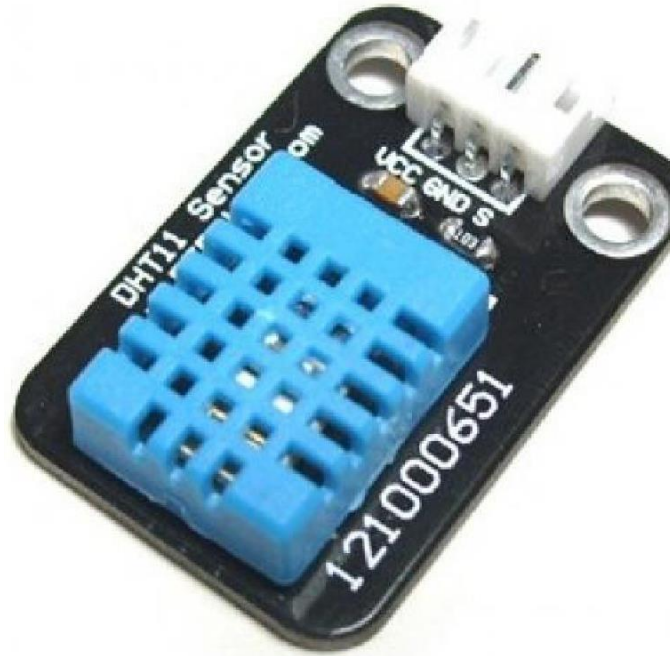
Sensor Details SW-420 :

Single-roller type full induction trigger switch. When no vibration or tilt, the product is ON conduction state, and in the steady state, when a vibration or tilt, the switch will be rendered instantly disconnect the conductive resistance increases, generating a current pulse signal, thereby triggering circuit. These products are completely sealed package, waterproof, dustproof.

Principle :

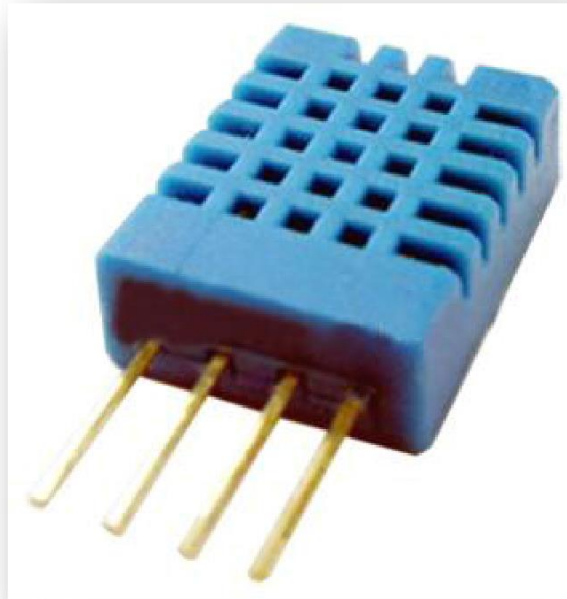
Usually at any angle switch is ON state, by the vibration or movement, the rollers of the conduction current in the switch will produce a movement or vibration, causing the current through the disconnect or the rise of the resistance and trigger circuit. The characteristics of this switch is usually general in the conduction state briefly disconnected resistant to vibration, so it's high sensitivity settings by IC, customers according to their sensitivity requirements for adjustments

DHT 11 Temperature Sensor :



Introduction :

This DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature & humidity sensing technology, it ensures high reliability and excellent long-term stability. This sensor includes a resistive-type humidity measurement component and an NTC temperature measurement component, and connects to a high-performance 8-bit microcontroller, offering excellent quality, fast response, anti-interference ability and cost-effectiveness.



Each DHT11 element is strictly calibrated in the laboratory that is extremely accurate on humidity calibration. The calibration coefficients are stored as programmes in the OTP memory, which are used by the sensor's internal signal detecting process. The single-wire serial interface makes system integration quick and easy. Its small size, low power consumption and up-to-20 meter signal transmission making it the best choice for various applications, including those most demanding ones. The component is 4-pin single row pin package. It is convenient to connect and special packages can be provided according to users' request.

Technical Specifications:

Overview:

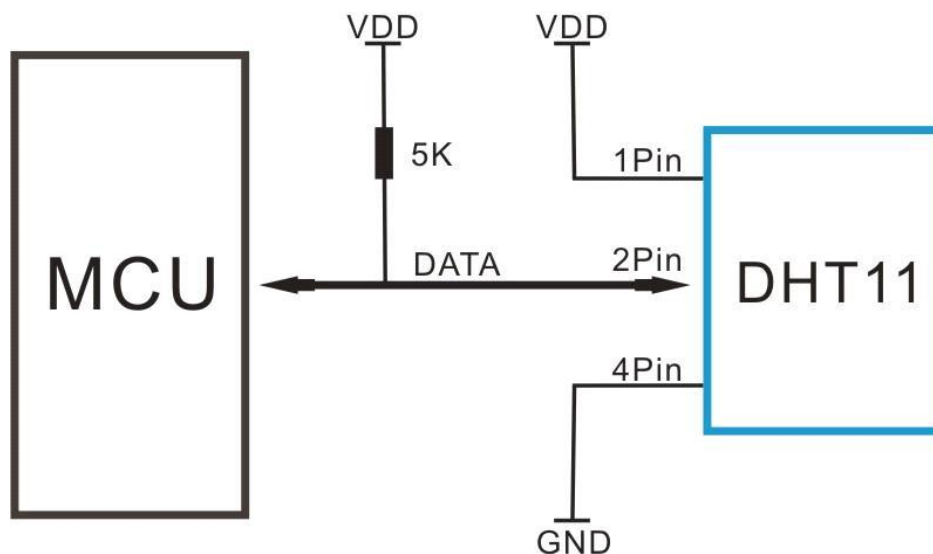
Item	Measurement Range	Humidity Accuracy	Temperature Accuracy	Resolution	Package
DHT11	20-90%RH 0-50 °C	±5%RH	±2°C	1	4 Pin Single Row

Detailed Specifications:

Parameters	Conditions	Minimum	Typical	Maximum
Resolution		1%RH	1%RH	1%RH
			8 Bit	
Repeatability			± 1%RH	
Accuracy	25°C		± 4%RH	
	0-50°C			± 5%RH
Interchangeability	Fully Interchangeable			
Measurement	0°C	30%RH		90%RH
Range	25°C	20%RH		90%RH
	50°C	20%RH		80%RH
Response Time (Seconds)	1/e(63%)25°C, 1m/s Air	6 S	10 S	15 S
Hysteresis			± 1%RH	

Long-Term Stability	Typical		$\pm 1\%RH/year$	
Temperature				
Resolution		1°C	1°C	1°C
		8 Bit	8 Bit	8 Bit
Repeatability			$\pm 1^{\circ}C$	
Accuracy		$\pm 1^{\circ}C$		$\pm 2^{\circ}C$
Measurement Range		0°C		50°C
Response Time (Seconds)	1/e(63%)	6 S		30 S

Typical Application



Typical Application

Note: 3Pin – Null; MCU = Micro-computer Unite or single chip Computer

When the connecting cable is shorter than 20 metres, a 5K pull-up resistor is recommended; when the connecting cable is longer than 20 metres, choose a appropriate pull-up resistor as needed

Power and Pin

DHT11's power supply is 3-5.5V DC. When power is supplied to the sensor, do not send any instruction to the sensor in within one second in order to pass the unstable status. One capacitor valued 100nF can be added between VDD and GND for power filtering.

Communication Process: Serial Interface (Single-Wire Two-Way)

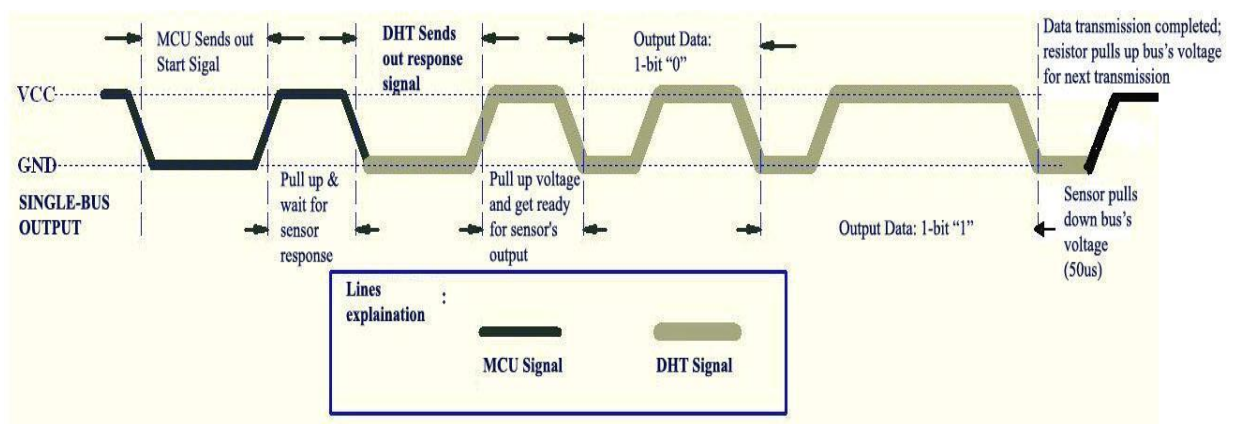
Single-bus data format is used for communication and synchronization between MCU and DHT11 sensor. One communication process is about 4ms.

Data consists of decimal and integral parts. A complete data transmission is **40bit**, and the sensor sends **higher data bit** first.

Data format: 8bit integral RH data + 8bit decimal RH data + 8bit integral T data + 8bit decimal T data + 8bit check sum. If the data transmission is right, the check-sum should be the last 8bit of "8bit integral RH data + 8bit decimal RH data + 8bit integral T data + 8bit decimal T data"..

Overall Communication Process

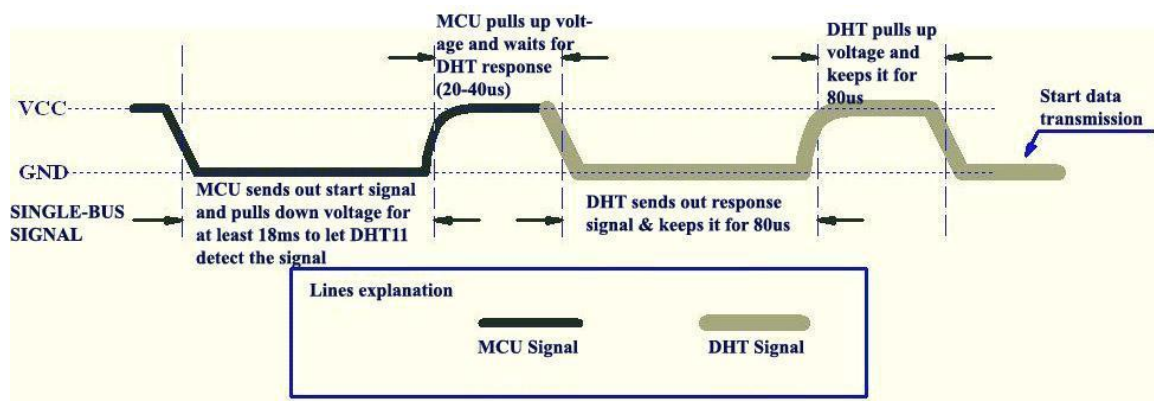
When MCU sends a start signal, DHT11 changes from the low-power-consumption mode to the running-mode, waiting for MCU completing the start signal. Once it is completed, DHT11 sends a response signal of 40-bit data that include the relative humidity and temperature information to MCU. Users can choose to collect (read) some data. Without the start signal from MCU, DHT11 will not give the response signal to MCU. Once data is collected, DHT11 will change to the low-power-consumption mode until it receives a start signal from MCU again.



Overall Communication Process

MCU Sends out Start Signal to DHT

Data Single-bus free status is at high voltage level. When the communication between MCU and DHT11 begins, the programme of MCU will set Data Single-bus voltage level from high to low and this process must take at least 18ms to ensure DHT's detection of MCU's signal, then MCU will pull up voltage and wait 20-40us for DHT's response.



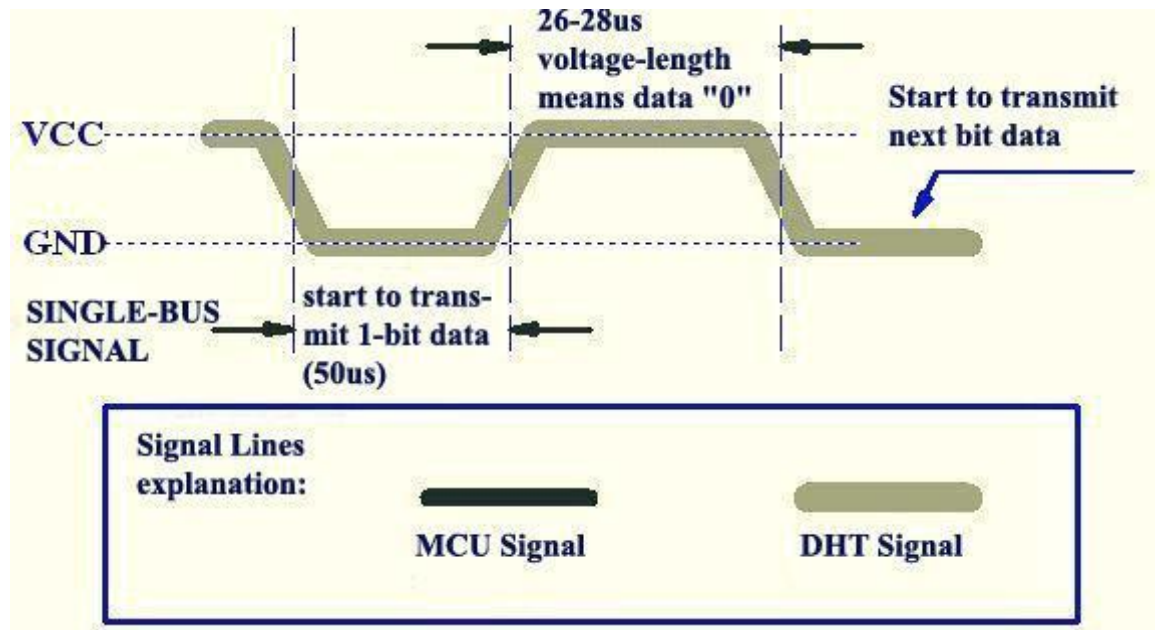
MCU Sends out Start Signal & DHT Responses

DHT Responses to MCU

Once DHT detects the start signal, it will send out a low-voltage-level response signal, which lasts 80us. Then the programme of DHT sets Data Single-bus voltage level from low to high and keeps it for 80us for DHT's preparation for sending data.

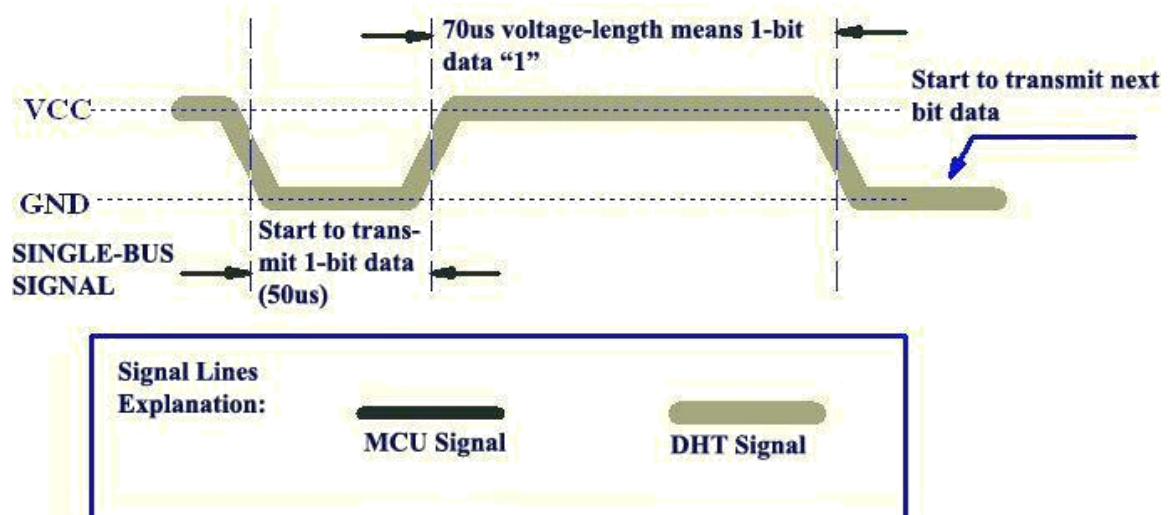
When DATA Single-Bus is at the low voltage level, this means that DHT is sending the response signal. Once DHT sent out the response signal, it pulls up voltage and keeps it for 80us and prepares for data transmission.

When DHT is sending data to MCU, every bit of data begins with the 50us low-voltage-level and the length of the following high-voltage-level signal determines whether data bit is "0" or "1"



Data "0" Indication

If the response signal from DHT is always at high-voltage-level, it suggests that DHT is not responding properly and please check the connection. When the last bit data is transmitted, DHT11 pulls down the voltage level and keeps it for 50us. Then the Single-Bus voltage will be pulled up by the resistor to set it back to the free status.



Data "1" Indication

Electrical Characteristics

VDD=5V, T = 25°C (unless otherwise stated)

	Conditions	Minimum	Typical	Maximum
Power Supply	DC	3V	5V	5.5V
Current Supply	Measuring	0.5mA		2.5mA
	Average	0.2mA		1mA
	Standby	100uA		150uA
Sampling period	Second	1		

Note: Sampling period at intervals should be no less than 1 second.

Attentions of application

(1) Operating conditions

Applying the DHT11 sensor beyond its working range stated in this datasheet can result in 3%RH signal shift/discrepancy. The DHT11 sensor can recover to the calibrated status gradually when it gets back to the normal operating condition and works within its range. Please refer to (3) of this section to accelerate its recovery. Please be aware that operating the DHT11 sensor in the non-normal working conditions will accelerate sensor's aging process.

(2) Attention to chemical materials

Vapour from chemical materials may interfere with DHT's sensitive-elements and debase its sensitivity. A high degree of chemical contamination can permanently damage the sensor.

(3) Restoration process when (1) & (2) happen

Step one: Keep the DHT sensor at the condition of Temperature 50~60Celsius, humidity <10%RH for 2 hours;

Step two: keep the DHT sensor at the condition of Temperature 20~30Celsius, humidity >70%RH for 5 hours.

(4) Temperature Affect

Relative humidity largely depends on temperature. Although temperature compensation technology is used to ensure accurate measurement of RH, it is still strongly advised to keep the humidity and temperature sensors working under the same temperature. DHT11 should be mounted at the place as far as possible from parts that may generate heat.

(5) Light Affect

Long time exposure to strong sunlight and ultraviolet may debase DHT's performance.

(6) Connection wires

The quality of connection wires will affect the quality and distance of communication and high quality shielding-wire is recommended.

(7) Other attentions

* Welding temperature should be bellow 260Celsius and contact should take less than 10 seconds.

* Avoid using the sensor under dew condition.

* Do not use this product in safety or emergency stop devices or any other occasion that failure of DHT11 may cause personal injury.

* Storage: Keep the sensor at temperature 10-40°C, humidity <60%RH.

MQ-5 SENSOR:

Description

The MQ5 Gas Sensor module is useful for gas leakage detecting. It can detect LPG, i-butane, methane, alcohol, Hydrogen, smoke and so on. The sensitivity can be adjusted using the on-board potentiometer, and you'd use this sensor by reading the analog pin to which it is connected. Please use these sensors only in controlled experiments! Combustible gases and fumes are very dangerous! Here are details for some MQ gas sensor.

Symbol	MQ-2	MQ-3	MQ-5	MQ-9
Detect Gas	Combustible Gas, Smoke	Alcohol Vapour	LPG, Natural Gas, Town Gas	Carbon Monoxide, Coal Gas, Liquefied Gas
Detect Concentration	300-10000ppm	0.04-4mg/L Alcohol	300-10000ppm	10-1000ppmCO;100-10000PPm Gas

Specification :

- Working voltage: 5V
- Working Current: 150mA
- DO: TTL output
- AO: Analog output, it will be higher with more such gas.
- Preheat time: Over 20s

OVERVIEW

- Sensitive for LPG, natural gas, coal gas
- Output voltage boosts along with the concentration of the measured gases increases
- Fast response and recovery
- Adjustable sensitivity
- Signal output indicator

Specifications

- Power: 2.5V ~ 5.0V
- Dimension: 40.0mm * 21.0mm
- Mounting holes size: 2.0mm

Applications

- Gas leakage detector

How to Use

In the case of working with a MCU:

- VCC ↔ 2.5V ~ 5.0V
- GND ↔ power supply ground
- AOUT ↔ MCU.IO (analog output)
- DOUT ↔ MCU.IO (digital output)

We will illustrate the usage of the module with an example of sensitive gas detection by connecting a development board.

1. Download the relative codes to the development board.
2. Connect the development board to a PC via a serial wire and the module to the development board. Then, power up the development board and start the serial debugging software.

Port	STM32 MUC pin
DOUT	GPIOA.4
AOUT	GPIOA.6
GND	GND
VCC	3.3V

Port	Arduino pin
DOUT	D2
AOUT	A0
GND	GND
VCC	5V

3. Warn-up the sensor for a minute.

4. The detected result can be checked by the LED indicator on the module. Put the sensor into a container filled with sensitive gas, you will find the indicator turns on. While take the sensor out of the container, you can see the indicator turns off.

Working Principle of Gas Sensor:

When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current. The gas sensor module consists of a steel exoskeleton under which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it.

DIMENSIONS OF MQ-5 SENSOR:



Voltage Regulator :

Description/Ordering Information

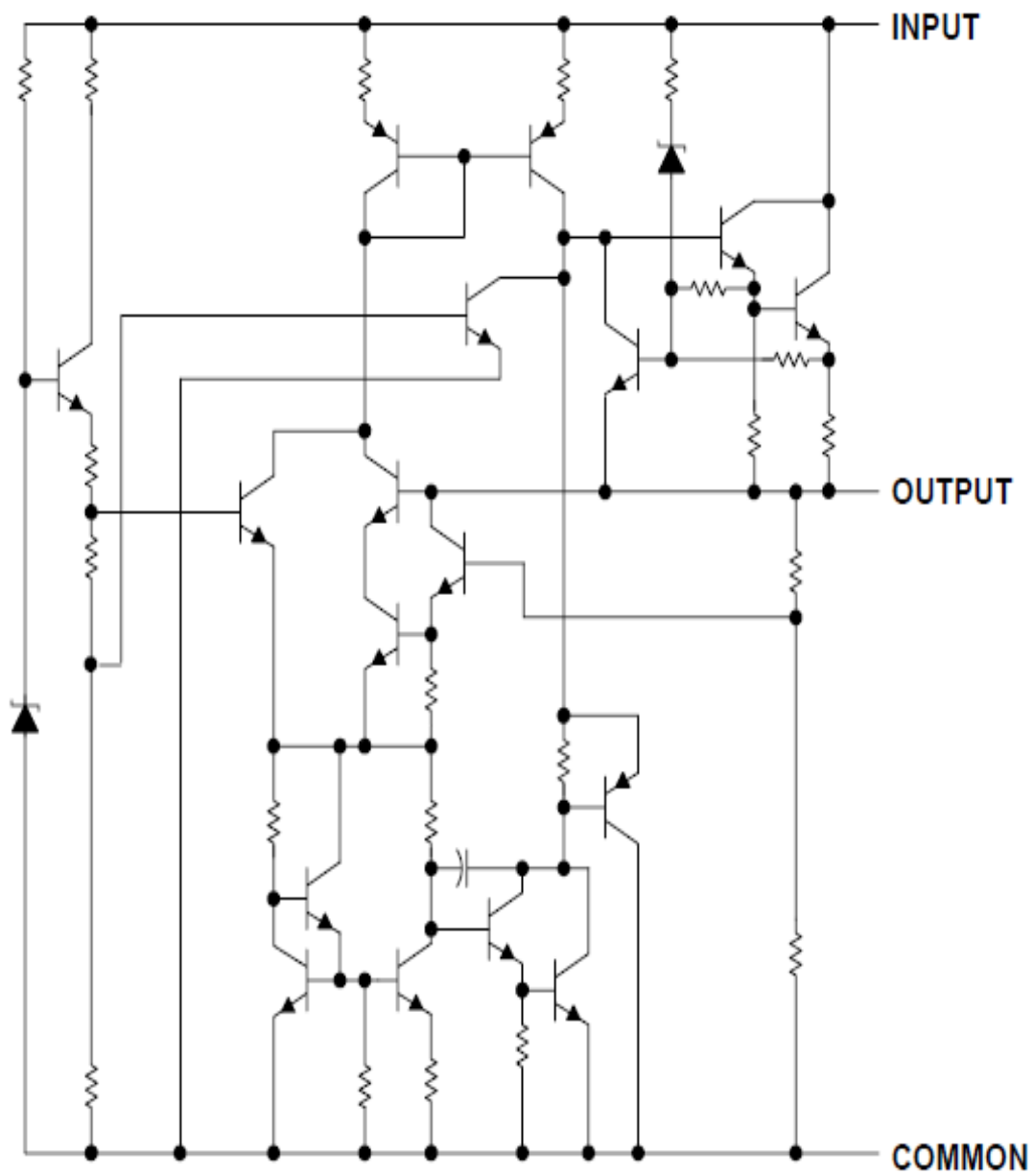
This series of fixed-voltage integrated-circuit voltage regulators is designed for a wide range of applications .These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. Each of these regulators can deliver up to 1.5 A of output current. The internal current-limiting and thermal-shutdown features of these regulators essentially make them immune to overload.

In addition to use as fixed-voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents, and also can be used as the power-pass element in precision regulators.

ORDERING INFORMATION :

T_J	V_{O(NOM)} (V)	PACKAGE†		ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 125°C	5	POWER-FLEX (KTE)	Reel of 2000	μA7805CKTER	μA7805C
		TO-220 (KC)	Tube of 50	μA7805CKC	μA7805C
		TO-220, short shoulder (KCS)	Tube of 20	μA7805CKCS	
	8	POWER-FLEX (KTE)	Reel of 2000	μA7808CKTER	μA7808C
		TO-220 (KC)	Tube of 50	μA7808CKC	μA7808C
		TO-220, short shoulder (KCS)	Tube of 20	μA7808CKCS	
	10	POWER-FLEX (KTE)	Reel of 2000	μA7810CKTER	μA7810C
		TO-220 (KC)	Tube of 50	μA7810CKC	μA7810C
	12	POWER-FLEX (KTE)	Reel of 2000	μA7812CKTER	μA7812C
		TO-220 (KC)	Tube of 50	μA7812CKC	μA7812C
		TO-220, short shoulder (KCS)	Tube of 20	μA7812CKCS	
	15	POWER-FLEX (KTE)	Reel of 2000	μA7815CKTER	μA7815C
		TO-220 (KC)	Tube of 50	μA7815CKC	μA7815C
		TO-220, short shoulder (KCS)	Tube of 20	μA7815CKCS	
	24	POWER-FLEX (KTE)	Reel of 2000	μA7824CKTER	μA7824C
		TO-220 (KC)	Tube of 50	μA7824CKC	μA7824C

Schematic Diagram :



Electrical characteristics at specified virtual junction temperature,
 $v_i = 10\text{ V}$, $i_o = 500\text{ mA}$ (unless otherwise noted)

PARAMETER	TEST CONDITIONS	T_J^\dagger	μA7805C			UNIT
			MIN	TYP	MAX	
Output voltage	$I_O = 5\text{ mA to }1\text{ A}$, $P_D \leq 15\text{ W}$	25°C	4.8	5	5.2	V
		$0^\circ\text{C to }125^\circ\text{C}$	4.75		5.25	
Input voltage regulation	$V_I = 7\text{ V to }25\text{ V}$	25°C		3	100	mV
	$V_I = 8\text{ V to }12\text{ V}$			1	50	
Ripple rejection	$V_I = 8\text{ V to }18\text{ V}$, $f = 120\text{ Hz}$	$0^\circ\text{C to }125^\circ\text{C}$	62	78		dB
Output voltage regulation	$I_O = 5\text{ mA to }1.5\text{ A}$	25°C		15	100	mV
	$I_O = 250\text{ mA to }750\text{ mA}$			5	50	
Output resistance	$f = 1\text{ kHz}$	$0^\circ\text{C to }125^\circ\text{C}$		0.017		Ω
Temperature coefficient of output voltage	$I_O = 5\text{ mA}$	$0^\circ\text{C to }125^\circ\text{C}$		-1.1		$\text{mV}/^\circ\text{C}$
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C		40		μV
Dropout voltage	$I_O = 1\text{ A}$	25°C		2		V
Bias current		25°C		4.2	8	mA
Bias current change	$V_I = 7\text{ V to }25\text{ V}$	$0^\circ\text{C to }125^\circ\text{C}$			1.3	mA
	$I_O = 5\text{ mA to }1\text{ A}$				0.5	
Short-circuit output current		25°C		750		mA
Peak output current		25°C		2.2		A

APPLIATION INFORMATION

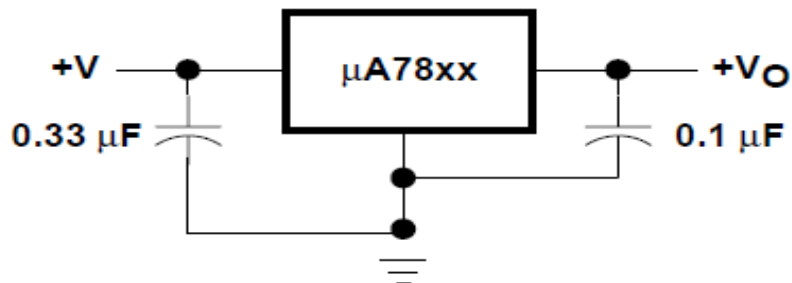
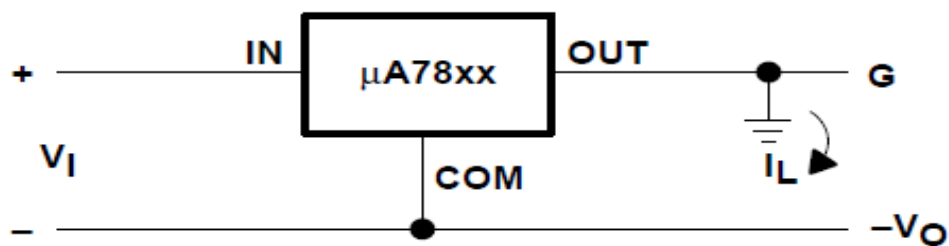
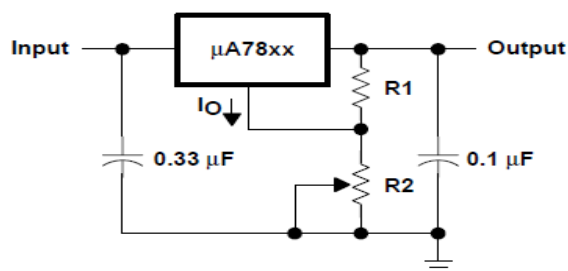


Figure 1. Fixed-Output Regulator



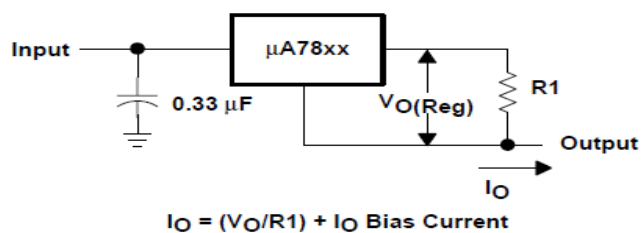
Positive Regulator in Negative Configuration (VI Must Float)

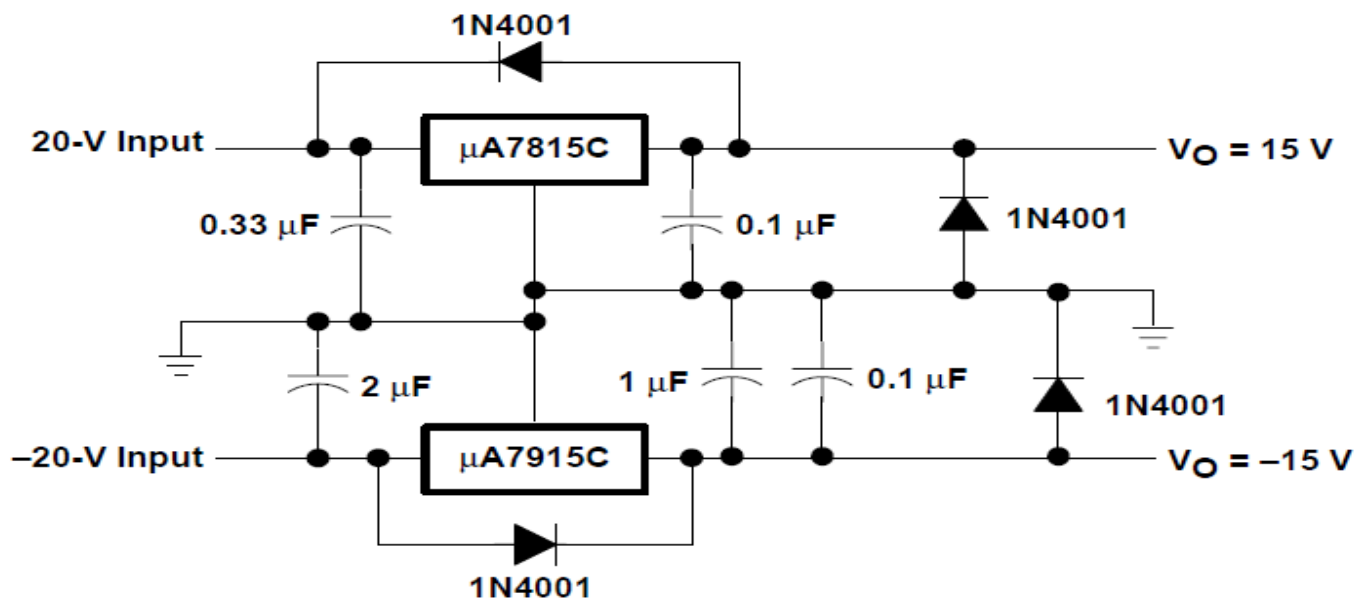


NOTE A: The following formula is used when V_{xx} is the nominal output voltage (output to common) of the fixed regulator:

$$V_O = V_{xx} + \left(\frac{V_{xx}}{R1} + I_O \right) R2$$

Figure 3. Adjustable-Output Regulator





Regulated Dual Supply

operation with a load common to a voltage of opposite polarity :

In many cases, a regulator powers a load that is not connected to ground but, instead, is connected to a voltage source of opposite polarity (e.g., operational amplifiers, level-shifting circuits, etc.). In these cases, a clamp diode should be connected to the regulator output as shown in. This protects the regulator from output polarity reversals during startup and short-circuit operation.

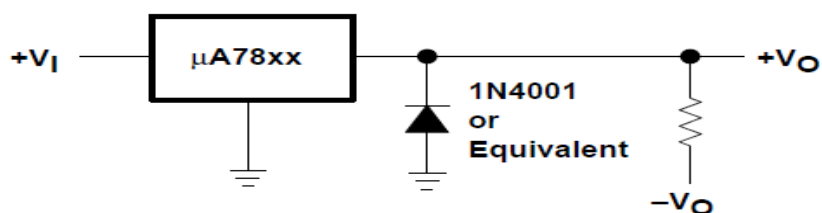
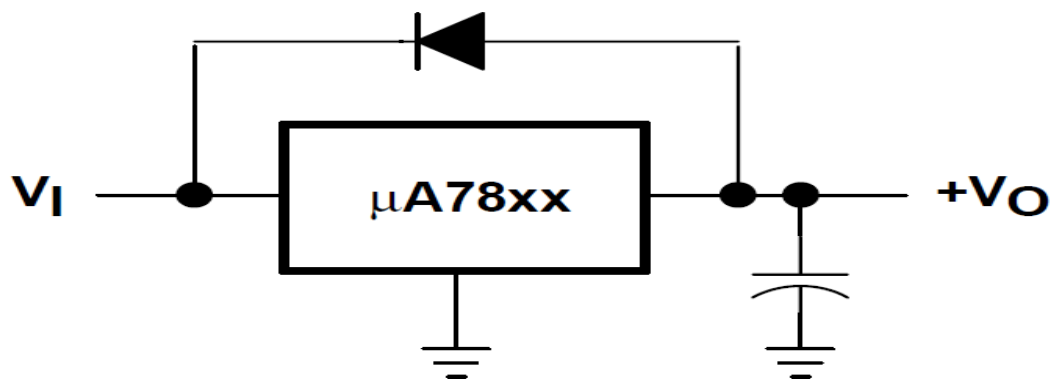


Figure 6. Output Polarity-Reversal-Protection Circuit

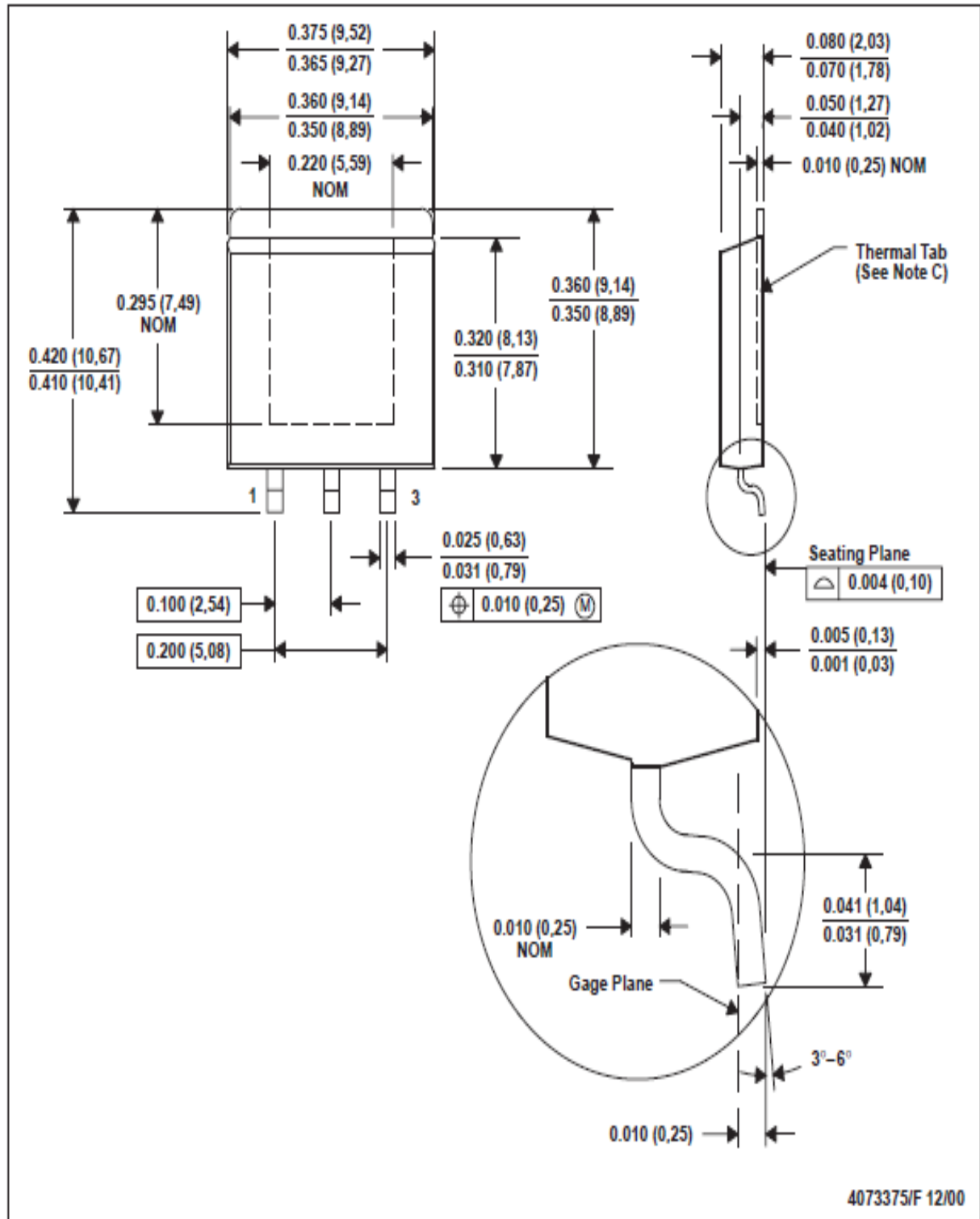
Reverse-Bias Protection

Occasionally, the input voltage to the regulator can collapse faster than the output voltage. This can occur, for example, when the input supply is crowbarred during an output overvoltage condition. If the output voltage is greater than approximately 7 V, the emitter-base junction of the series-pass element (internal or external) could break down and be damaged. To prevent this, a diode shunt can be used.



Reverse-Bias-Protection Circuit

KTE (R-PSFM-G3)



SOFTWARE DETAILS

SOFTWARE DETAILS:

How To Program Arduino:

Once the circuit has been created on the breadboard, you'll need to upload the program (known as a sketch) to the Arduino. The sketch is a set of instructions that tells the board what functions it needs to perform. An Arduino board can only hold and perform one sketch at a time. The software used to create Arduino sketches is called the IDE which stands for Integrated Development Environment. The software is free to download and can be found at <https://www.arduino.cc/en/Main/Software>

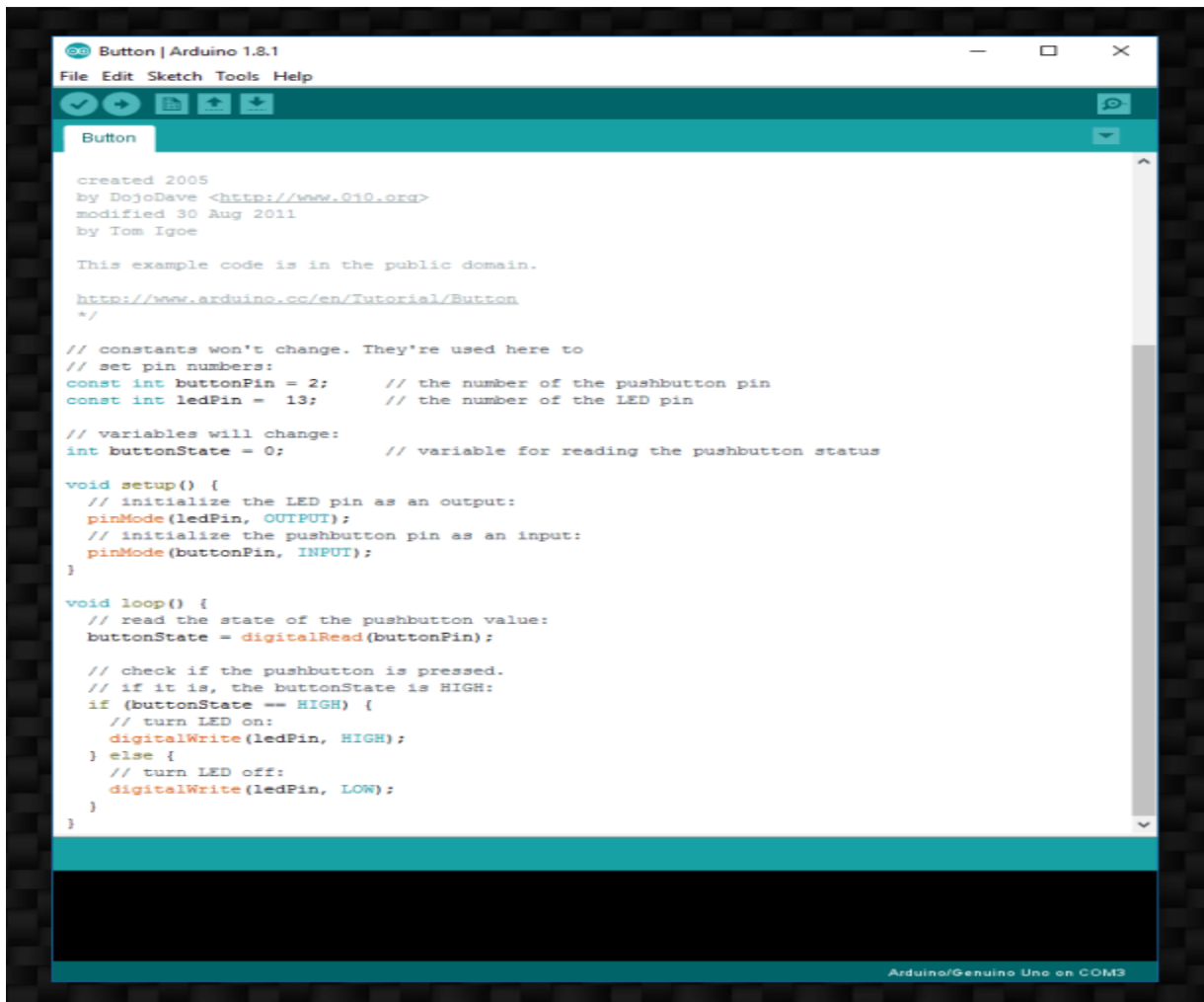
Every arduino sketch has two main parts to the program:

Void setup() – Sets things up that have to be done once and then don't happen again.

Void loop () – Contains the instructions that get repeated over and over until the board is turned off.

How Everything Works Together

Check out our quick Arduino video to see how a breadboard, Arduino, jumper wires and the sketch work together to perform a function. In this video, we use a momentary push button switch to blink an LED.



Download The Software:

At this point, we're ready to download the free software known as the IDE. The Arduino IDE is the interface where you will write the sketches that tell the board what to do.

You can find the latest version of this software on the Arduino IDE download page.



ARDUINO

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. It runs on Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software.

This software can be used with any Arduino board. Refer to the [Getting Started](#) page for installation instructions.

Windows [Installer](#)
[Windows ZIP file for non admin install](#)

Windows app 

Mac OS X [10.7 Lion or newer](#)

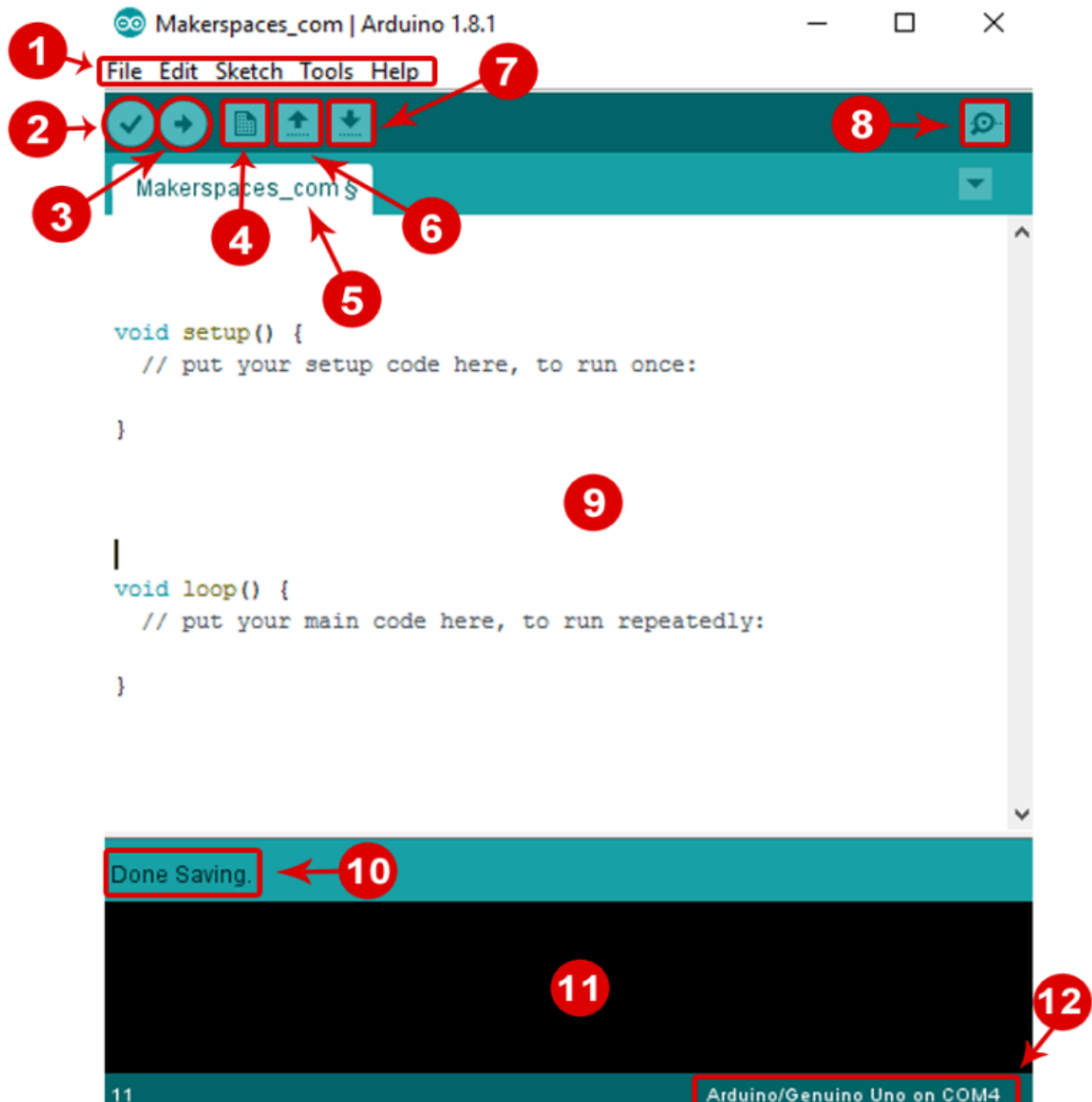
Linux [32 bits](#)
[64 bits](#)
[ARM](#)

[Release Notes](#)
[Source Code](#)
[Checksums \(sha512\)](#)

To install the software, you will need to click on the link that corresponds with your computer's operating system.

Arduino IDE :

Once the software has been installed on your computer, go ahead and open it up. This is the Arduino IDE and is the place where all the programming will happen. Take some time to look around and get comfortable with it.



Fi g .26

1. **Menu Bar:** Gives you access to the tools needed for creating and saving Arduino sketches.
2. **Verify Button:** Compiles your code and checks for errors in spelling or syntax.

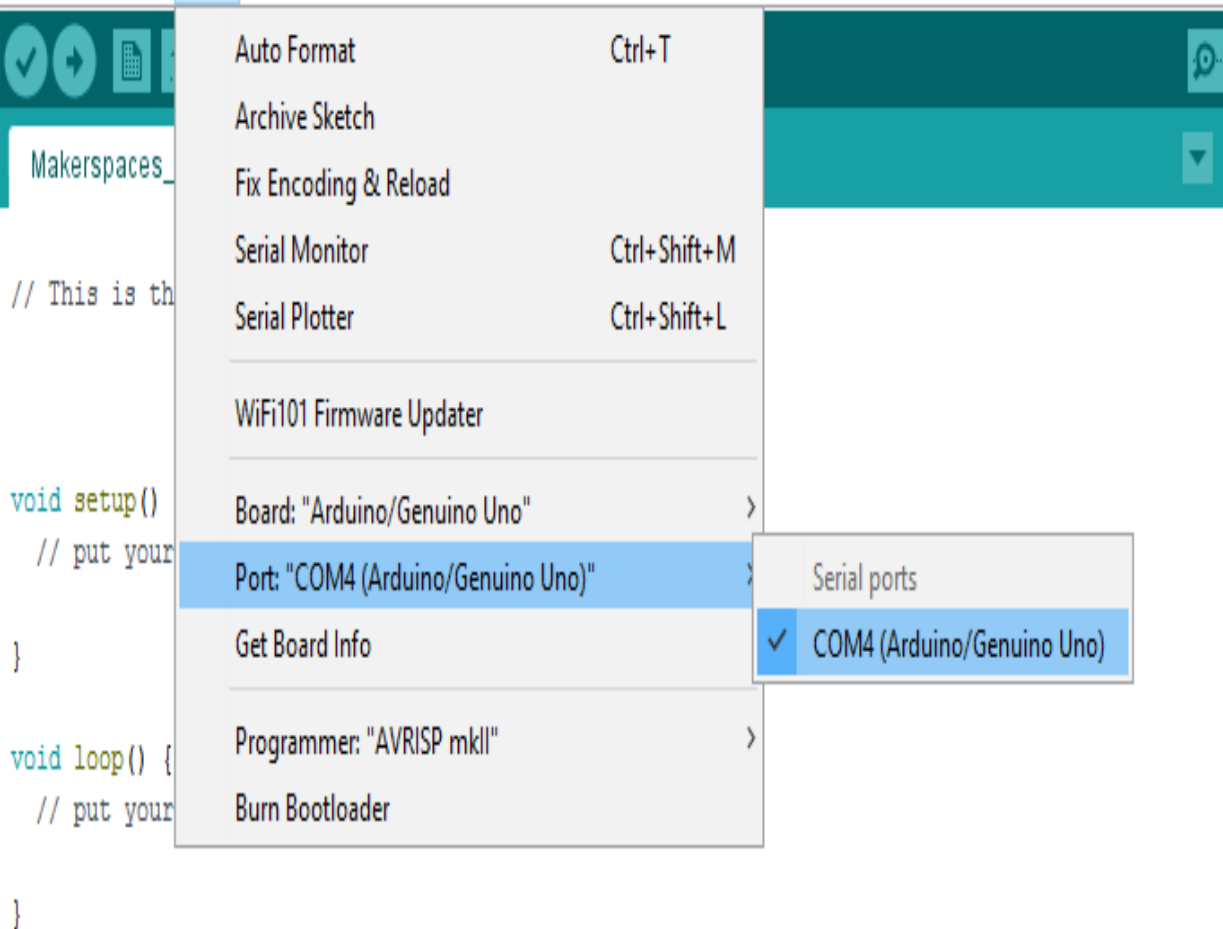
3. **Upload Button:** Sends the code to the board that's connected such as Arduino Uno in this case. Lights on the board will blink rapidly when uploading.
4. **New Sketch:** Opens up a new window containing a blank sketch.
5. **Sketch Name:** When the sketch is saved, the name of the sketch is displayed here.
6. **Open Existing Sketch:** Allows you to open a saved sketch or one from the stored examples.
7. **Save Sketch:** This saves the sketch you currently have open.
8. **Serial Monitor:** When the board is connected, this will display the serial information of your Arduino
9. **Code Area:** This area is where you compose the code of the sketch that tells the board what to do.
10. **Message Area:** This area tells you the status on saving, code compiling, errors and more.
11. **Text Console:** Shows the details of an error messages, size of the program that was compiled and additional info.
12. **Board and Serial Port:** Tells you what board is being used and what serial port it's connected to.

Connect Your Arduino :

At this point you are ready to connect your Arduino to your computer. Plug one end of the USB cable to the Arduino Uno and then the other end of the USB to your computer's USB port.

Once the board is connected, you will need to go to Tools then Board then finally select Arduino Uno.

File Edit Sketch Tools Help



PROGRAM

PROGRAM:

```
#include <ESP8266WebServerSecure.h>
#include <ESP8266WebServerSecureAxTLS.h>
#include <ESP8266WebServerSecureBearSSL.h>

#include <BearSSLHelpers.h>
#include <CertStoreBearSSL.h>
#include <ESP8266WiFi.h>
#include <ESP8266WiFiMulti.h>
#include <ESP8266WiFiScan.h>
#include <ESP8266WiFiSTA.h>
#include <ESP8266WiFiType.h>
#include <WiFiClient.h>
#include <WiFiClientSecure.h>
#include <WiFiClientSecureAxTLS.h>
#include <WiFiClientSecureBearSSL.h>
#include <WiFiServer.h>
#include <WiFiServerSecure.h>
#include <WiFiServerSecureAxTLS.h>
#include <WiFiServerSecureBearSSL.h>
#include <WiFiUdp.h>

#include <ESP8266WiFi.h>
#include <ESP8266WebServer.h>
#include "DHT.h"

// Uncomment one of the lines below for whatever DHT sensor type you're using!
#define DHTTYPE DHT11 // DHT 11
// #define DHTTYPE DHT21 // DHT 21 (AM2301)
// #define DHTTYPE DHT22 // DHT 22 (AM2302), AM2321

/*Put your SSID & Password*/
const char* ssid = "ASUS_X00TD"; // Enter SSID here
const char* password = "anudeep1"; //Enter Password here

ESP8266WebServer server(80);

// DHT Sensor
uint8_t DHTPin =D4;

// Initialize DHT sensor.
DHT dht(DHTPin, DHTTYPE);
```

```

float Temperature;
float Humidity;
int smokesensor=D2;
bool Smoke;
int vibration = D1;
int vibrationstate = 0;
String vibrationstatus;
String gas_sensor_status;
void setup() {
  Serial.begin(115200);
  delay(100);
  pinMode(DHTPin, INPUT);
  pinMode(smokesensor,INPUT);
  pinMode(vibration, INPUT);
  Serial.println("start");
  dht.begin();

  Serial.println("Connecting to ");
  Serial.println(ssid);

  //connect to your local wi-fi network
  WiFi.begin(ssid, password);

  //check wi-fi is connected to wi-fi network
  while (WiFi.status() != WL_CONNECTED) {
    delay(1000);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected..!");
  Serial.print("Got IP: "); Serial.println(WiFi.localIP());

  server.on("/", handle_OnConnect);
  server.onNotFound(handle_NotFound);

  server.begin();
  Serial.println("HTTP server started");

}
void loop() {

  server.handleClient();
  Smoke = digitalRead(smokesensor);
  if(Smoke==LOW){

```

```

    gas_sensor_status="Leak";
}
    if(Smoke==HIGH){
        gas_sensor_status="Normal";
    }
    int vibrationvalue = digitalRead(vibration);
    if (vibrationvalue == LOW) {
        // Serial.print("Vibration");
        vibrationstatus="Enable";
    }else{
        Serial.print("Vibration");
        vibrationstatus="Disable";
    }
}

void handle_OnConnect() {

    Temperature = dht.readTemperature(); // Gets the values of the temperature
    Humidity = dht.readHumidity(); // Gets the values of the humidity
    server.send(200, "text/html", SendHTML(Temperature,Humidity));

}

void handle_NotFound(){
    server.send(404, "text/plain", "Not found");
}

String SendHTML(float Temperaturestat,float Humiditystat){
    String ptr = "<!DOCTYPE html> <html>\n";
    ptr += "<head> <meta http-equiv=\"refresh\" content=\"4\">";
    ptr += "<title>ESP8266 Weather Report</title>\n";
    ptr += "<style>html { font-family: Helvetica; display: inline-block; margin: 0px auto; text-align: center;}\n";
    ptr += "body{margin-top: 50px;} h1 {color: #444444;margin: 50px auto 30px;}\n";
    ptr += "p { font-size: 24px;color: #444444;margin-bottom: 10px;}\n";
    ptr += "</style>\n";
    ptr += "</head>\n";
    ptr += "<body>\n";
    ptr += "<div id=\"webpage\">\n";
    ptr += "<h1>ESP8266 NodeMCU Weather Report</h1>\n";
    ptr += "<p>Temperature: ";
    ptr += (int)Temperaturestat;
    ptr += "°C</p>";
    ptr += "<p>Humidity: ";

```

```
ptr +=(int)Humiditystat;
ptr += "%</p>";
ptr += "<p>Gas:";
ptr += gas_sensor_status;
ptr += "</p>";
ptr += "<p>Vibration:";
ptr += vibrationstatus;
ptr += "</p>";
ptr += "</div>\n";
ptr += "</body>\n";
ptr += "</html>\n";
return ptr;
```


SOLDERING INSTRUCTIONS

CLEANING FOR SOLDERING:

- a. Ensure that parts to be soldered and the PCB are clean and free from dirt and grease.
- b. Use isopropyl alcohol with the help of non-static Bristol brush for cleaning.
- c. Use lint free muslin cloth for alternatively use mild soap solution followed by thorough rinsing with water and drying.

TIPS FOR GOOD SOLDERING:

- 1) Use 15 to 25 watt soldering iron for general work involving small joints and for CMOS IC's, FETs and ASICs use temperature controlled soldering station ensuring that the tip temperature is maintained within 330-350deg.Centigrade.
- 2) For bigger joints use elevated temperature as per job.
- 3) Before using a new tip, ensure that it is tinned and before applying the tip to the job, wipe it using a wet sponge.
- 4) Use 60:40(tin: lead)
- 5) Ensure that while applying the tip to the job, the tip of the soldering iron is held at an angle such that the tip grazes the surface to be heated and ensure that it does not transfer heat to other joints/components in its vicinity at the same time heating all parts of joints equally.
- 6) HEAT the joint for just the right amount of time, during which a very short length of solder flows over the joint and then smoothly withdraw the tip.
- 7) Do not carry molten solder to the joint.
- 8) DO not heat the electronic parts for more than 2-4 secs since most of them are sensitive to heat.
- 9) Apply one to three mm solder which is neither too less nor too much and adequate for a normal joint.
- 10) Do not move the components until the molten solder at the joint has cooled.

TIPS FOR DE- SOLDERING:

- 1) Remove and re-make if a solder joint is bad or dry.
- 2) Use a de-soldering pump which is first cocked and then the joint is heated in the same way as during soldering and when the solder melts, push the release button to disengage the pump.
- 3) Repeat the above operation 2-3 times until the soldered component can be comfortably removed using tweezers or long nose pliers.
- 4) Deposit additional solder before using the re-soldering pump for sucking it in case of difficulty in sucking the solder if it too spares as this will hasten the de-soldering operation.
- 5) Alternately, use the wet de- soldering wick using soldering flux which is nothing but affine copper braid as a shield in co-axial cables etc. and then press a short length of the wick using the tip of the hot iron against the joint to be de- soldered so that the iron melts the solder which is drawn into the braid.
- 6) Do not allow the solder to cool while the braid is still adhering to the joint.
- 7) Solder the component again after cleaning by repeating the steps under sub A and B above.
- 8) Allow it to cool and check for continuity.

PRECAUTIONS:

1. Mount the components at the appropriate places before soldering follow the circuit description and components details, lead identification etc. Do not start soldering before making it confirm that all components are mounted at the right place.
2. Do not use a speared soldering on the board, it may cause short circuit.
3. Do not sit under the fan while soldering .
4. Position the board so that gravity tends to keep the solder where you want it.
5. Do not over heat the components at the board. Excess heat may damage the components or board.
6. The board should not vibrate while soldering otherwise you have a dry or a cold joint.

CONCLUSION

Conclusion :

A mining helmet is developed that is able to detect different types of hazardous events such as, humidity condition of mines, then temperature and existence of combustible gases, the helmet removing by miner, and light intensity inside the mines.

Heart of the system is Raspberry pi 3 who control and monitor the all these events using IOT. This system is displaying the parameters on the base station PC and alerting miner, from base station higher authority can monitor every thing, which can provides rescue operation for the miner. The first is the presence of the hazardous gases such as CO, SO₂, NO₂, and particulate matter exceed its limit raspberry pi sends information through IoT to the base station and alert the miner through buzzer.

The second is the measurement of environmental humidity and temperature around miner, which is done by sensors used. In the third case if the miner removes his helmet off their head. Then to determine successfully when the helmet is on the miner's head an off-the-shelf IR sensor is used. The fourth is the measurement of light intensity inside the mines if the light intensity becomes low raspberry pi informs the miner by buzzer. So this project is useful for the persons who are working in the underground, or in mines.

The system can be further improved. To allow the transmissions to the control station or supervisor node hopping can be implemented. The system can also be improved by adding the sensors to detect collision inside the mines, and we can also add the devices to check the miner's heart rate and blood pressure.

BIBLIOGRAPHY

BIBLOGRAPHY:

- ✚ *Interview with Alex Bassi, IoT-A Technical Coordinator, IoT-Architecture Community Newsletter, i. 4*
- ✚ *IoT Design Manifesto 1.0. Guidelines for Responsible Design in a Connected World*
- ✚ *Riforma del copyright e portabilità dei contenuti: le proposte della Commissione europea, Diritto Mercato Tecnologia, 09.12.2015*
- ✚ *User Data Manifesto 2.0*
- ✚ **ADRODEGARI F., BACCHETTI A., ZANARDINI M.,** Agenda Digitale.eu, 14.12.2015
- ✚ **ANDJELIC A.,** *The Devil Shares Prada: Consumers Want Experiences, Not Products*, 29.07.2015
- ✚ **ARIELY D., SILVA J.,** *Payment Method Design: Psychological and Economic Aspects of Payments*, Center for eBusiness @MIT, 20.08.2002

References on the Web:

- ✚ <http://iot.nexacenter.org/>
- ✚ www.national.com
- ✚ www.atmel.com
- ✚ <https://www.arduino.cc/en/Main/Software>
- ✚ www.geocities.com

ENVIRONMENTAL MANAGEMENT

1. What is the responsibility of an Engineer-in-charge of an Industry with respect to Public Health?

The responsibility of an Engineer-in-charge of an industry with respect to public health are:

- a. To control the pollutions, form an industry.
- b. Provide safe drinking water to the workers.
- c. Provide waste water management.
- d. Provide means to dispose the solid waste.
- e. Provide a clean environment in the industrial area.

2. Define Environmental Ethic.

Environmental Ethics is a branch of philosophy concerned with the moral relations between human beings and the nature. It refers to the issues, principles and guidelines relating to human interactions with their environment.

3. How Industries play their role in polluting the environment?

Industries pollute the environment in many ways. The most common is the water pollution caused by dumping industrial wastes into water ways, improperly covering the industrial wastes which pollute the ground water. Industrial gases pollute the air quality. Pollutants can kill animals and plants, create imbalance in ecosystem, degrade air quality, and generally the quality of life.

4. What is the necessity of pollution control? What are all the different organizations you know, which deal with pollution control?

Pollution affect the quality of life and is injurious to health. Hence, pollution in any form is to be controlled. The aim of pollution control is to reduce the hazard of the pollutant. The different organizations that deal with pollution control are:

- a. State pollution control board.
- b. Central pollution control board.
- c. National Environmental Engineering Research Institute.

5. List out the different types of pollutions caused by a Chemical / Textile / Leather / Automobile / Cement factory.

Chemical Industry	Water pollution, air pollution and land pollution
Textile industry	Water pollution, air pollution
Leather industry	Water pollution, soil pollution
Automobile industry	Air pollution, noise pollution
Cement industry	Air pollution, water pollution, land pollution

6. What is meant by Hazardous waste?

Chemical, biological, flammable, explosive, radioactive wastes etc. which can create danger immediately or over a long period of time are called as Hazardous wastes. The pollutants can be in solid, liquid or gaseous forms.

7. Define Industrial waste management.

Industrial waste management is the collection, transportation, processing, recycling or disposal and monitoring of waste materials.

8. Differentiate between garbage, rubbish, refuse and trash based on their composition and source.

Garbage: It includes all types of semi-solid and solid waste food materials such as vegetables, peeling of fruits, waste meats etc.

Rubbish: It refers to all various forms of solid wastes such as paper, broken furniture, waste building materials etc.

Refuse: It includes all solid and semi-solid waste matters of a community except night soil (human wastes). It can be classified as a) Organic matter b) Inorganic matter. The organic form of refuse is dangerous to health.

Trash: It includes materials that are thrown away because of zero utility or worthlessness or poor quality.

9. Explain briefly how the quantity of solid waste generated in an industry could be reduced.

The solid wastes generated by the industry can be reduced by the following methods.

- a. Reduction in waste volume by segregation and reuse or recycling of wastes.
- b. Good housekeeping.
- c. Prevention of leaks and spills.

10. What are the objectives of treatments of solid wastes before disposal?

- a. The disposal of solid waste is done far away from the cities using engineering principles.
- b. The wastes are disposed in a smallest possible area to reduce the volume and prevent them from rodents and vermin.
- c. Separation of the non-combustible waste products.
- d. Separation of the organic wastes.
- e. Removal of toxic products.

11. What are the different methods of disposal of solid wastes?

The different methods of disposal of solid wastes are:

- a. Open dumping
- b. Sanitary land fill
- c. Incineration
- d. Composting

12. Explain how the principle of recycling could be applied in the process of waste minimization.

Waste materials generated during the production process can be reused or recycled either onsite or offsite. Recycling of waste materials requires some form of significant physical, chemical or biological processing. For example, in a paper industry, the used paper may be pulped and remanufactured.

13. Define the term ‘Environmental Waste Audit’.

The important process which deals with the actual generation of waste in an industrial unit is the waste audit. A waste audit enables us to take a complete look at the site or process to facilitate the material flow and to focus the attention on areas where waste reduction and cost saving is possible.

14. List and discuss the factors pertinent to the selection of landfill site.

Factors that are pertaining to the selection of landfill are:

- a. The landfill area should be far from the residential areas.
- b. The value of land selected for landfill should be minimum.
- c. The landfill area should be easily accessible.
- d. The landfill should affect the soil and ground water.

The capacity of landfill is based on the volume of waste.

15. Explain the purpose of daily cover in a sanitary landfill and state the minimum desirable depth of daily cover.

Daily cover is applied to the working faces of the landfill at the close of operation on each day. Daily cover is used to control the generation of disease vectors such as insects and rats. It also prevents the blowing of materials away from the working face. The daily cover needs are expressed in waste and soil ratio. The waste soil ratio ranges from 4:1 to 10:1. The minimum daily cover thickness consists of 6” to 1’.

16. Describe any two methods of converting waste into energy.

a. Thermal process

The solid wastes are burnt in a furnace, called incinerator. The combustible and non-combustible substances are separated before they are fed into incinerators. The non-combustible materials are left out for recycling and reuse. The left-out ashes and clinkers from the incinerator are disposed by landfill or by some other means. The heat generated in the incinerator during the burning of refuse is used in the form of steam power to drive turbines for generation of electricity.

b. Pyrolysis and gasification

In this method, the materials are heated at high temperature. The solid wastes are converted into liquid state, and the liquid is converted into gas. The gas is used to produce electrical energy by using gas turbines.

17. What actions, a local body such as a municipality could take when the agency appointed for collecting and disposing the solid wastes fails to do the work continuously for number of days?

- a. Proper action can be initiated against the agency.
- b. The wastes are disposed by using the services of the nearby municipality workers or other labourers.
- c. Medical facilities are arranged to the people to prevent the spreading of diseases.

18. Write a note on Characteristics of hazardous waste.

A waste may be hazardous if it possesses one or more than the following characteristics.

- a. Ignitability: It is the property by which the hazardous waste catches fire quickly during the process of transportation, storage, treatment and disposal. Example: Oil.
- b. Corrosivity: Hazardous waste of high pH (Hydrogen ion concentration) or very low pH, less or equal to 2 or greater than 12.5 exhibit the property of corrosion.
- c. Reactivity: Reactive wastes are unstable. Due to faster rate of reaction, the explosive state of conditions is created during transport, storage, treatment and disposal. Hence, a reactive waste is a hazardous waste.
- d. Toxicity: Poisonous substances are said to be toxic.
- e. Radio activity: It is a spontaneous breakdown of the nucleus of the atom. There are three types of radiation in radioactive hazardous materials, namely α , β , and γ rays.

19. What is the difference between municipal and industrial effluent?

Municipal effluent: They are in the form of either solid or semisolid generated by the society such as garbage, rubbish, demolition wastes, construction wastes, ashes, street refuse, garden wastes etc.

Industrial effluent: The liquid wastes from industrial process which uses large volumes of water are referred to as industrial effluent or wastes.

20. List few of the undesirable parameters / pollutants anticipated in the effluents from oil refinery industry / thermal power plants / textile industries / woollen mills / dye industries / electroplating industries / cement plants / leather industries (any two may be asked)

Oil refinery industry	Acids, alkalis, petroleum oils
Thermal power plant	Heavy metals, heat dissolved solids, inorganic compounds
Textile industries	Alcohol, acids, enzymes, silicates, chlorine, dues, chromium, oil, phenol, soap etc.
Woollen mills	Alcohol, acids, enzymes, silicates, chlorine, dues, chromium, oil, phenol, soap etc.
Dye industries	Organic acids, chlorides, nitro compound dyes.

Electroplating industries	Metallics, toxic cyanides, cadmium, chromium, zinc, copper, aluminium.
Cement plants	Dust particles
Leather industry	Calcium, chromium, high salt content, dissolved suspended matter

21. Explain briefly the process of Equalization and Neutralization of waste water of varying characteristics discharged from an Industry.

Equalisation: It is the holding of waste water in a continuously mixing chamber for some predetermined time to produce a uniform waste water.

Neutralisation: It means neutralising the excessive acidity or alkalinity of the waste water by adding alkaline or acid respectively to the waste water. This may be achieved by equalisation tank.

22. Explain briefly the Physical treatments “Sedimentation” and “Floatation” processes in the waste water treatment.

Sedimentation: It is used to separate the heavier settleable solids. A sedimentation tank may be provided only when the waste water contains a high percentage of such heavy inorganic solids, such as soil, pebbles etc.

Floatation: In this method, air bubbles are created in the waste water by air into the tank from bottom. The rising air bubbles attach themselves to the fine suspended particles, increasing their buoyancy and lifting them to the liquid surface for easier removal.

23. Explain briefly when and how chemical / biological treatments are given to the waste water.

If the waste water contains chemical and bacteriological impurities, then chemical and biological treatments are given to the waste water. Biological and chemical treatments are used to remove most of the organic matter present in the waste water. In the chemical treatment, chemicals are added to remove the sedimentation and dissolved solids. The commonly used chemicals are alum, lime, ferrous sulphate, ferric chloride etc.

Biological treatments are used to remove non-settleable and colloidal solids. In this treatment, microorganisms are used to convert the colloidal and dissolved carbonaceous organic matter into various gases and into cell tissues.

24. List the four commonly used advanced waste water treatment processes and the pollutants they remove.

The commonly used advanced waste water treatment methods and the pollutants removed are:

- Micro straining – Removes suspended solids.
- Solvent extraction – Removes organic dissolved solvents.
- Reverse osmosis – Removes inorganic dissolved solids.
- Nitrification and denitrification – Removes nitrogen.

25. Describe refractory organics and the method used to remove them from the effluent.

Soluble organics may be present in the waste water even after the secondary treatment and filtration. These remaining materials are called refractory organics. A predetermined amount of hydrogen per oxide is added to the waste water containing organic pollutants. The mixture is thoroughly mixed and UV light is passed through the mixture. The UV light breaks down the hydrogen per oxide into hydroxyl. This hydroxyl oxidises the refractory organic compound.

26. Explain biological nitrification and de-nitrification.

Nitrification: Microorganisms (bacteria) converts ammonium compound the soil into nitrate salts. This process of converting ammonium salts into nitrates is called nitrification.

Denitrification: Denitrifying bacteria convert nitrates and ammonia into free nitrogen. This process is called denitrification. This reduces soil fertility, and agricultural productivity.

27. Describe the basic approaches to land treatment of Industrial Effluent.

If the industrial effluents are dumped in land for long time, the soil surface of the land becomes hazardous. So, a land treatment unit is used to reduce the toxicity of the soil. The chemical and biological process of the land treatment degrades the hazardous particles in the soil.

28. Describe the locations for the ultimate disposal of sludge and the treatment steps needed prior to ultimate disposal.

Locations for the disposal of sludge:

- a. Disposal on land.
- b. Distribution by pipe lines.
- c. Drying on drying beds.
- d. Dumping into the sea.
- e. Heat drying.
- f. Incineration.
- g. Ponding.

Treatment before disposal:

Disposal on land: Sludge can be disposed on land by following two methods:

- a. Ploughing: In this method, the sludge is mixed with lime water or powder and is spread on the land. When the sludge is dried out, the field is ploughed.
- b. Trenching: In this method, about 600mm deep and 900mm wide parallel trenches are made in the field. The trenches are then filled with sledge and covered with a thin layer of evacuated earth. The process is repeated by digging new trenches between the old ones and right angles to the previous ones.

- c. Incineration: When the sludge cannot be used as fertilizers, then it may be incinerated. For incineration, the sludge is first dried, and then it is kept in furnace. Then it is ignited and turned into ash.

29. List any five Industries, which act as the major sources for Hazardous Air Pollutants.

- a. Steel mills
- b. Thermal power plants.
- c. Oil refineries.
- d. Pulp and paper mills.
- e. Food processing plants.

30. List out the names of any three hazardous air pollutants and their effects on human health.

Hazardous air pollutants are a) Beryllium b) Mercury c) Asbestos

- a) Beryllium: Acute Beryllium exposure will affect the membranes of the eyes and lungs. Chronic beryllium exposure is a poisoning which starts with progressive shortness of breath, weight loss and cough. It may finally affect many organs, including heart and can cause lung cancer.
- b) Mercury: Mercury causes Neurological damage, and kidney damage. Methyl mercury can penetrate the membranes separating the body stream from the brain.
- c) Asbestos: Inhalation of asbestos dust or fibres can cause lung diseases such as asbestosis, lung cancer.

31. Explain the influence of moisture, temperature and sunlight on the severity of air pollution effects on materials.

Aiding factors	Materials	Effects
Temperature	Metals	No longer brightness of metal surface.
Moisture	Building mat, metals, paints, ceramics, textiles	Discolouration in building mat, metal, paints and ceramics, dye fading in textiles.
Sunlight	Paper Rubber Textiles	Embrittlement Cracking Dye fading, additional cleaning is necessary in laundry

32. Differentiate between acute and chronic health effects from Air pollution.

Short term exposure to air pollutants at high concentration will cause immediate acute health effects.

Chronic health effects become evident only after continuous exposure to low levels of air pollutants.

33. Define the term Acid rain and explain how it occurs.

Normal rain water is always slightly acidic because CO_2 present in the atmosphere gets dissolved in it. Because of the presence of SO_2 and NO_2 gases as pollutants in the atmosphere, the pH value of the rain water is lowered. This type of precipitation of water is called acid rain.

Formation: Thermal power plants, industries and vehicles releases nitrous oxide and sulphur dioxide into atmosphere due to burning of coal and oil. When these gases react with water vapour in the atmosphere they form weak acids and fall on to the earth as acid rain.

34. Discuss briefly the causes for global warming and its consequences

The increase in CO_2 and other greenhouse gases (Methane, Nitrous oxide, Chlorofluorocarbon, Ozone) into the atmosphere because of human activities, will enhance the earth's natural greenhouse effect to raise the average global temperature of the atmosphere near the earth's surface. The enhanced greenhouse effect is called Global warming.

The following would be possible consequences of global warming.

- a. The global temperature is increased.
- b. Climate changes occur across countries.
- c. Agricultural and livestock are affected.
- d. Forest and natural ecosystem is threatened.
- e. Raise in the sea level.

35. Suggest suitable Air pollution control devices for a few pollutants and sources.

The following items are commonly used as pollution control devices.

- a. Gravitational settling chambers: For removal of dust particles.
- b. Cyclone filters: For removal of gas particles and dry dust particles.
- c. Wet collectors or scrubbers: For removal of dust particles from gas stream.
- d. Electrostatic precipitators: Removal of dirty gas and mist.

36. Explain how evaporative emissions and exhaust emissions are commonly controlled.

Evaporative emission: Evaporative emissions are the result of gasoline vapours escaping from the vehicle's fuel system. The vapours from the fuel tank, carburettor bowl vent are ducted to canisters containing activated carbon. The vapours are absorbed within the canister and during certain engine operational modes fresh air is drawn through the canister, pulling the vapour back into the engine where it is burned.

Exhaust emission: To reduce the exhaust emission from automobiles, the following emission control systems are used.

- a. Exhaust gas recirculation system
- b. Air injection method
- c. Catalytic reduction

In exhaust gas recirculation system, the emitted gas is continuously recirculated through the engine, so that the burning air fuel mixture is diluted. Here the amount of

NO_x is reduced. In catalytic reduction method, the nitric oxide is reduced to nitrogen and hydrocarbon. Carbon monoxide is oxidised to carbon-di-oxide and water.

37. What are the harmful elements present in the automobile smokes? How their presence could be controlled?

The harmful elements are a) Carbon monoxide b) Oxides of nitrogen.

Carbon monoxide: Both thermal and catalytic exhaust system reactors are used to reduce carbon monoxide and hydrocarbon emissions.

Oxides of Nitrogen: Emission from automobiles are controlled by two methods a) Exhaust gas recirculation b) Catalytic reduction.

Exhaust gas recirculation: Emitted gas is continuously recirculated through the engine, so that the burning air fuel mixture is diluted. The amount of NO_x is reduced.

Catalytic reduction: Nitric oxide (NO) is reduced to nitrogen and hydrocarbon. CO is oxidised to carbon dioxide and water.

38. What is the Advantage of Ozone layer in the atmosphere? State few reasons for its destruction.

Ozone (O₃) is an important chemical present in the atmosphere 30 km above the earth's surface. The ozone layer present in the atmosphere acts as a protective shield for life on earth by absorbing UV radiations from the sun. Ozone layer is destroyed by the Chlorofluorocarbon (CFC). The CFCs are released into the atmosphere by refrigeration units, air conditioning systems and cleaning solvents. CFC release chlorine in the ozone layer and each atom of chlorine thus liberated will attack the ozone molecules. Due to this, the ozone layer becomes thin which leads to the formation of hole in the ozone layer.

39. Explain the mechanism by which hearing damage occurs.

Sound pressure waves caused by vibration will set the ear drum in motion. This activates the three bones in the middle ear (Anvil, hammer and stirrup) This will transmit the sound waves into the inner ear and to the tiny hair cells. Acute damage can occur to the ear drum by sudden loud noise. Prolonged noise at certain frequency can cause chronic damage to the tiny hair cells in the inner ear. Due to this effect, temporary or permanent hearing loss occurs.

40. List any five effects of noise other than hearing damage.

- a. Noise pollution causes muscles to contract, leading to nervous breakdown and tension.
- b. It may cause damage to heart, brain, kidneys, liver etc.
- c. Ultrasonic sound can affect the digestive and respiratory systems. It also affects the rate of heart beat.
- d. Brain is also adversely affected by loud and sudden noise such as that of a jet and aeroplane noise.
- e. Blood is thickened by excessive noises.

41. Explain why impulsive noise is more dangerous than steady state noise.

Impulsive noise is a random or sudden occurrences of irregular noise spikes of high amplitude for a short duration. They are unwanted sharp sounds that are caused by electromagnetic interferences, explosions, gunshots etc. High levels of such noise may damage internal organs such as eardrum, ear bone, inner ear etc. So impulsive noise is more dangerous than steady state noise.

42. Explain briefly the Source – Path – Receiver concept of Noise control.

The combination of source-path and receiver concept is used for controlling noise pollution.

- a. Source control: This may include source modification such as acoustic treatment to machine surfaces, design changes, limiting the operational timings etc.
- b. Transmission path intervention: The sound source is contained in a sound insulating enclosure. Also, a noise barrier (shield) may be constructed. A sound absorbing materials may be placed along the path.
- c. Receptor control: This include protection of the receiver by altering the work schedule or provision of personal protection devices such as ear plugs for operating noise of machinery.

43. Where silencers or mufflers are used? Explain how they reduce the noise.

Silencers or mufflers are used in automobiles and industries to reduce noise. A muffler is a device for reducing the amount of noise emitted by a machine. In internal combustion engine, the engine exhaust blows through the muffler. Mufflers are properly installed along the exhaust pipe of the exhaust system of IC engine to reduce the exhaust noise.

44. Describe two techniques to protect the receiver from hearing loss when design / redress for noise control fail.

The best way to prevent hearing loss due to noise is

- a. To eliminate or reduce the noise level.
- b. When noise cannot be eliminated, the individuals are protected from noise by wearing hearing protection such as ear plugs or cotton in the ears.

45. What are the problems faced by the people residing along the side of a railway track and near to an Airport? What provisions could be made in their houses to reduce the problem?

People living along the railway track and near the airport will be exposed to excessive noise which may cause severe mental stress, higher blood pressure and hearing loss.

DISASTER MANAGEMENT

1. What is meant by Disaster Management? What are the different stages of Disaster management?

Disaster is an event or series of events which seriously disturb the normal activities. Disaster management is a pre-planned prevention, preparation, emergency action and recovery from disasters to save human life and property and restore normal life as quickly as possible. The different stages of disaster management are:

- a. Planning
- b. Mitigation
- c. Preparedness
- d. Response
- e. Recovery

2. Differentiate Natural Disasters and Manmade Disasters with examples.

Natural Disasters:

Natural disaster is the effect of a natural hazard that affect the environment and leads to financial, environmental and/or human losses.

Examples: Floods, Cyclones, Drought, Earthquake, Tsunami, Snow storms, Heat waves.

Man-made Disasters:

Man-made disasters are events which either intentionally or by accident cause severe threats to public health and well-being.

Examples: Setting of fires, Epidemic, pollution, wars, accidents, food poisoning, terrorism.

3. Describe the necessity of Risk identification and Assessment Surveys while planning a project.

Risk identification ascertains which risks have the potential of affecting the project and documenting the risk characteristics. Risk identification begins after the risk management plan is constructed and continues iteratively throughout the project execution. The risk identification process naturally progresses into the Quantitative Risk Analysis or the Qualitative Risk Analysis.

4. What is Disaster recovery and what does it mean to an Industry?

Disaster recovery is a process of policies and procedures related to preparing for recovery and continuation of technology infrastructure critical to an organisation after a natural or man-made disaster. Disaster recovery in industries include the following factors:

- a. Failure due to fire accidents.
- b. Failure due to sudden high voltage supply.
- c. Failure of machineries and infrastructure due to floods.

5. What are the factors to be considered while planning the rebuilding works after a major disaster due to flood / cyclone / earthquake? (Any one may be asked)

The factors to be considered while planning the rebuilding works after a major disaster due to flood/ cyclone/ earthquake are:

- a. Land and planning.
- b. Prevent to build in risk zone.
- c. Construct disaster resistant building.
- d. Take possible protective activities to avoid disaster.
- e. Community awareness and education.

6. List out the public emergency services available in the state, which could be approached for help during a natural disaster.

- a. Police – Phone No. 100
- b. Fire control – Phone No. 101
- c. Ambulance of Fire service dept – Phone No. 102
- d. Traffic police – Phone No. 103
- e. Ambulance services – Phone No. 108
- f. Women help line – Phone No. 1091
- g. Child line – Phone No. 1098
- h. Lions blood bank – Phone No. 1910

7. Specify the role played by an Engineer in the process of Disaster management.

Disaster is a threat to environment and the society. Disaster management deals with preparations to reduce the impact of natural or man-made disasters. The role of an Engineer is given below:

- a. Mitigation: It focuses on avoiding hazards or reducing the impact of disaster.
- b. Preparedness: It involves developing action plans to combat disaster when it happens.
- c. Response: It includes mobilisation of emergency services for evacuation and rescue operations.
- d. Recovery: It is involved in the rebuilding process.

8. What is the cause for Earthquakes? How they are measured? Which parts of India are more vulnerable for frequent earthquakes?

An earthquake is a sudden motion or trembling of the ground produced by the abrupt displacement of rock masses. Earthquakes are recorded with a seismometer also known as seismography in Richter magnitude. The magnitude of 3 or lower earthquakes being mostly imperceptible and the magnitude of 7 or more causing serious damage over large areas. The modified Mercalli intensity scale is used for measuring intensity of shaking. The following parts of India are more vulnerable to frequent earthquakes.

- a. Gujarat
- b. Jammu and Kashmir
- c. Punjab
- d. Assam

e. Manipur

9. What was the cause for the Tsunami 2004 which inflicted heavy loss to life and property along the coast of TamilNadu? Specify its epicentre and magnitude.

Tsunamis are a series of extremely long waves that are created after a large volume of water is displaced. Tsunami can be generated by four ways. They are an undersea earthquake, landslide, volcanic eruption and an extra-terrestrial collision. The 2004 Indian Ocean earthquake was undersea megathrust earthquake that occurred at 00.58.53 UTC on 26-12-2004. This tsunami occurred at an epicentre of west coast of Sumatra with a magnitude of between 9.1 to 9.3 in Richter Scale. The 2004 Tsunami killed over 3,00,000 people with many bodies either being lost to sea or unidentified.

10. Specify the Earthquake Hazard Zones in which the following towns of Tamil Nadu lie: (a) Chennai (b) Nagapattinam (c) Coimbatore (d) Madurai (e) Salem.

Earth quake hazards can be categorized as either direct hazards or indirect hazards.

Direct hazards: Ground shaking, floods from tidal waves, sea surges and Tsunamis, Soil liquefaction etc.

Indirect hazards: Failure of dams, pollution from damage to industrial plants, delayed landslides etc.

Most of the regions from Tamil Nadu fall under low to moderate seismic hazard zone.

Madurai – Low hazard – Rating: 0

Nagapattinam – Low hazard – Rating: 0

Salem – Low hazard – Rating: 0

Chennai – Low hazard – Rating: 0.3-0.5

Coimbatore – Moderate hazard – Rating: 0.7-0.8

11. Which parts of India are experiencing frequent natural calamities such as (a) heavy rain fall (b) huge losses due to floods (c) severe cyclones.

Heavy rainfall: Cherapunji

Huge loss due to floods: Andhra Pradesh, West Bengal

Severe Cyclones: Andhra Pradesh, Tamil Nadu, Gujarat, West Bengal

12. Define basic wind speed. What will be the peak wind speed in (a) Very high damage risk zone – A, (b) High damage risk zone, (c) Low damage risk zone.

Wind speed is the speed of wind, the movement of air or other gases in an outside environment. The highest surface wind speed ever officially recorded is 372km/h at the Mount Washington in the US on 12th April 1934. The highest surface wind speed ever officially recorded in Asia was in Afghanistan on 14th August 2008.

13. Specify the minimum distance from the Sea shore and minimum height above the mean sea level, desirable for the location of buildings.

The minimum distance from the seashore for the location of buildings is 500 meters. The desirable height above the mean sea level for buildings is 61 feet.

14. Explain how the topography of the site plays a role in the disasters caused by floods and cyclones.

Topography is the study of the earth's surface and its features. Topographic map uses symbols and colouring with proper attention given to the shape and elevations of terrain. The shape of the new buildings is the most important single factor in determining the performance of buildings in cyclones. Simple, compact and symmetrical shapes are best. The square plan is better than the rectangular plan, since it allows high winds to go around them.

15. Explain how the shape and orientation of buildings could reduce the damages due to cyclones.

- a. A circular or polygonal shape is preferred for individual buildings. But for functional efficiency, a square plan is desirable.
- b. A symmetrical building about both axes with a compact plan form is more stable than a zigzag plan, having empty packets, since the later is more prone to wind/ cyclone related damages.
- c. In locating a group of buildings, a cluster arrangement should be chosen in preference to row type buildings.
- d. The building orientation should be such that the shorter span length of the wall faces the sea.
- e. Aspect ratio of the building should not be greater than 3.
- f. The opening in the building will encourage flooding. Hence, large openings on the sea side should be avoided.

16. What is a cyclone shelter? When and where it is provided? What are its requirements?

Cyclone shelters are the places used for accommodating the cyclone affected people during cyclones. They are provided in densely populated areas. Cyclone shelters should be designed for multipurpose uses such as school building, community halls or any public utility buildings, so as to ensure that these buildings are used and maintained during normal times.

17. What Precautionary measures have to be taken by the authorities before opening a dam for discharging the excess water into a canal/river?

- a. Proper intimation to the people through radio, television and loud speaker.
- b. Strengthening of weak river banks by using sand bags.
- c. Alerting the rescue team at the spot with plastic boats.
- d. Preventing people to go near the canal.

18. What are the causes for fire accidents? Specify the remedial measures to be taken in buildings to avoid fire accidents.

Causes of fire accidents:

- a. Heating sources such as heaters, electric grills etc.
- b. Candles, lighted match sticks, cigarettes and crackers.
- c. Spark in electrical wiring.
- d. Combustible materials like flammable liquids or gases.

Safety measures:

- a. Always an adult should be present during cooking time. Children should not be allowed alone.
- b. Make sure that the curtains of the window near the stove are tied and will not blow on to the flame.
- c. Switch off the burner after cooking.
- d. Keep the matches out of reach of children.
- e. After usage, put-off the candles.
- f. Do not keep any combustible materials near the stove.
- g. Maintain the electrical wiring and appliances properly.

19. What is a fire escape in multi-storeyed buildings? What are its requirements?

Multi-storey building is a building that has multiple floors above the ground. The aim of a multi-storey building is to increase the area of the building without increasing the area of land.

A fire escape is a special kind of emergency exit, usually provided at the outside of a building, but separated from main entrance. The fire escape requirements are described below:

- a. Each floor should have facility of water pipe with tube to extinguish minor fires inside the building.
- b. Fire smoke sensors, toxic sensors have to be implanted in each flat of the building for alerting people.
- c. The fire escape exit should be known to all the inmates.
- d. Connect the bridge corridor to the emergency exit on each floor.

20. How the inmates of a multi-storey building are to be evacuated in the event of a fire/Chemical spill/Toxic Air Situation/ Terrorist attack, (any one may be asked).

- a. An emergency corridor and ladder for multi-storeyed building comprising a bridge corridor, a safety ladder and a temporary emergency shelter may be provided in each floor.
- b. The bridge corridor is connected to the emergency exit on each floor, with both sides of the corridor are respectively provided with fire-blocking wall.
- c. A safety ladder is provided along the bridge corridor such that the safety ladders are connected together from the top floor to the ground level.
- d. The man hole can be used to cooperate with emergency escape rod so that the people can slide down to the ground level.
- e. An automatic sprinkler system can be provided on the walls. The sprinkler turns on when a fire spreads out and all personnel can pass through the bridge corridor safely to enter into the emergency shelter.

21. Describe different firefighting arrangements to be provided in an Industry.

The different fire-fighting arrangements in an industry are:

- a. Water spray system.
- b. Fire extinguishers.
- c. Sand buckets.
- d. Fire alarm systems
- e. Smoke detectors.
- f. CO₂ extinguishing system.
- g. Fire engine.

22. Explain the necessity of disaster warning systems in Industries.

- a. To avoid heavy losses.
- b. To avoid building and machinery losses.
- c. To avoid casualties.
- d. To safeguard the power supply and communication system.
- e. To safeguard the productive materials.

23. Explain how rescue operations have to be carried out in the case of collapse of buildings due to earthquake / blast / Cyclone / flood.

In case of collapse of any building, it should be notified to the fire and rescue department. The rescue operation can be done only by skilled persons. The location of people under rubble and their excavations can be achieved with relatively simple search and rescue operations. First aid is to be provided to retrieve the persons from the building. Collapsed structures are to be removed with help of cranes.

24. What are the necessary steps to be taken to avoid dangerous epidemics after a flood disaster?

- a. Rescue of victims.
- b. Provision of emergency medical care.
- c. Provision of water, food, clothing and shelter.
- d. Disposal of human waste.
- e. Provision of preventive and routine medical care.
- f. Control of vector borne diseases.
- g. Disposal of human bodies.
- h. Disposal of solid waste.

25. What relief works that have to be carried out to save the lives of workers when the factory area is suddenly affected by a dangerous gas leak / sudden flooding?

Dangerous gas leak:

- a. Relief gas to be provided in the factory.
- b. Safety mask is to be worn immediately.
- c. Warning messages through Sirens, alarms, and loudspeakers.
- d. Arrangement of first aid facilities.

Sudden flood:

- a. Warning messages through sirens, alarms and loudspeakers
- b. Accommodation has to be provided in a safe place.
- c. Arrangement of first aid facilities.
- d. Arrangement of plastic boats.
- e. Initiate drainage process.
- f. Call for emergencies like fire service, national safe guard service, police for rescue operation.

26. What are the difficulties faced by an Industry when there is a sudden power failure? How such a situation could be managed?

The difficulties are:

- a. Products may be damaged.
- b. Accident may occur.
- c. Machines may be damaged.
- d. Total production may be reduced.
- e. Difficult to satisfy the customers.
- f. Cost of production may be increased.

27. What are the difficulties faced by the Management when there is a group clash between the workers? How such a situation could be managed?

The supervisor is responsible to monitor the workers inside the factory. In case of any group clash, it must be reported to the union and management for solving the problem.

The difficulties faced by the management are:

- a. Loss of production.
- b. Loss of raw material.
- c. Financial problem.
- d. Damage to the company properties.
- e. Theft and assassination.

These situations can be managed by

- a. Calling police service
- b. Calling fire service
- c. Arranging union meeting and solving the problems
- d. Counselling the workers.
- e. Compensation may be given to the affected persons.

28. What will be the problems faced by the management of an Industry when a worker dies because of the failure of a mechanical device due to poor maintenance? How to manage such a situation?

- a. The management should provide compensation to the deceased worker's family.
- b. The management should give assurance to the workers to rectify the faults of the mechanical device and maintain properly in future.

- c. The management should give assurance to the workers to give job opportunity to any one of the deceased member.
- d. The management should give one or two days leave to the workers for urgent maintenance works.

The problems faced by the management are:

- a. Strike by the workers.
- b. Loss of production
- c. Clash between management and workers.
- d. Proper maintenance.

29. What precautionary measures have to be taken to avoid accidents to labourers in the Industry in a workshop / during handling of dangerous Chemicals / during construction of buildings / during the building maintenance works.

The following precautionary measures may be taken to avoid accidents:

- a. Safety devices should be provided.
- b. Proper material handling should be used.
- c. Floor should be maintained without any oil spill.
- d. Pathway projection should be avoided.
- e. Cranes should be used to lift heavy loads.
- f. Fire extinguishers should be provided.
- g. Helmets, safety ladder, safety shoes, gloves, safety goggles, muffle masks should be worn during working.
- h. Respiratory equipment should be placed in the industry.

30. Explain the necessity of medical care facilities in an Industry / Project site.

The necessity of Medical care facilities in an industry/ Project site are:

- a. First aid may be given to the affected workers.
- b. In case of an accident, workers may be injured, and production may be reduced.
- c. Due to sickness, workers may be absent from work.
- d. Quality of production may be reduced.

31. Explain the necessity of proper training to the employees of Industries dealing with hazardous products, to act during disasters.

- a. The workers should know to safely operate the machines
- b. The workers should be trained to trouble shoot for overcoming troubles.
- c. The workers should be trained to properly handle the hazardous products to avoid accidents.
- d. The training may help the workers to do their jobs in an interesting manner.

32. What type of disaster is expected in coal mines, cotton mills, Oil refineries, ship yards and gas plants?

Disaster in Coal mines:

- a. Mine flooding
- b. Tensile crack and peeling of the roof

- c. Fire
- d. Leak of poisonous gas

Disaster in oil refineries:

- a. Fire and explosions
- b. Leakage of poisonous gas

Disaster in cotton mills:

- a. Fire
- b. Building collapse

Disaster in shipyard:

- a. Flood
- b. Cyclone
- c. Fire
- d. Tsunami

33. What is meant by Emergency Plan Rehearsal? What are the advantages of such Rehearsals?

Emergency plan rehearsal is a method of action procedure to be carried out during an unexpected disaster. The rehearsals are conducted to show the workers as to how to get during emergency when disaster occurs.

Advantages:

- a. It minimises the loss of property
- b. Reduces the loss of lives.
- c. Reduces the fear of attack.

34. What action you will take when your employees could not reach the factory site because of continuous strike by Public Transport workers?

- a. Arrangement of private vehicles from different areas.
- b. Quarters and foods may be provided.
- c. Fuel compensation may be allowed for workers if they have own vehicles.

35. What immediate actions you will initiate when the quarters of your factory workers are suddenly flooded due to the breach in a nearby lake / dam, during heavy rain?

- a. The people are transferred to safety places or instructed to occupy the top of the building with costly things.
- b. Initiate the drainage process.
- c. Provide emergency medical care.
- d. Provide water and food.

36. What steps you will take to avoid a break down when the workers union of your Industry have given a strike notice?

- a. Arrange a meeting and discuss their problems with management
- b. Discussion should be frank and free without reservation
- c. Grievance procedures should be provided
- d. Provide proper communication channels
- e. Give compensation to the workers

37. List out few possible crises in an organization caused by its workers? What could be the part of the middle level officials in managing such crisis?

Crisis management is the process by which an organisation deals with a major unpredictable event that threatens to harm the organisation, its stake holders or general public. Some possible crises are:

- a. Strike by employees.
- b. Slow down the work.
- c. Pen down strike.
- d. Picketing.

Middle level officers are the bridges between the management and the workers. They have to take care of the worker's safety and should be given proper counselling every time when needed. They can recommend the management for the workers grievances.

38. What types of warning systems are available to alert the people in the case of predicted disasters, such as floods, cyclone etc.

Sirens, alarms, loudspeakers, TV and Radio are the warning systems available to alert the people in case of predicted disasters.

39. Explain the necessity of Team work in the crisis management in an Industry / Local body.

Team work plays an important role in crisis management. A team is an integral unit, working towards organizational objectives and goals, rather than aggregate of individuals working on independent goals. In team work, skills and knowledge can be constructively used to execute the crisis. For most effective team work, all the individuals must get involved in the work. There should be mutual relationship between top management and front-line employees to overcome the problem in an efficient and easy manner.

40. What factors are to be considered while fixing compensation to the workers in the case of severe accidents causing disability / death to them?

Factors to be considered for fixing the compensation:

- a. Company's Policies
- b. Provident fund facility
- c. Employee's age
- d. Level of disability

41. Explain the legal / financial problems the management has to face if safety measures taken by them are found to be inadequate.

If the safety measures taken by the management is inadequate, accidents are prone to happen. Because of this the management has to face the following financial problems:

- a. Medical expenses are to be provided
- b. Compensation should be given.
- c. Production will be disturbed.
- d. Legal expenses.
- e. Machine replacement or repairing costs.
- f. Unaffected workers will have mental disturbance, with reduction in production.

42. Describe the importance of insurance to men and machinery of an Industry dealing with dangerous jobs.

Insurance to life of men and machinery play an important role in an industrial organisation. Sudden and unexpected breakdown will affect the financial strength of management. So, to compensate these failures, it is important to have insurance coverage to the working personnel and the valuable machines of the industry.

43. What precautions have to be taken while storing explosives in a match/ fire crackers factory?

- a. Boards like NO SMOKING, CELL PHONES PROHIBITED should be displayed in and around the plant.
- b. Proper shielding of electrical lines inside the factory.
- c. Fire extinguishers and smoke detectors should be placed inside the industry.
- d. Suitable ventilation and lighting must be provided.
- e. Explosives should be isolated and shielded by high fire-resistant materials.

44. What are the arrangements required for emergency rescue works in the case of Atomic Power Plants?

- a. Boards like NO SMOKING, CELL PHONES PROHIBITED should be displayed in and around the plant.
- b. Fire extinguishers, smoke detectors should be placed inside the plant.
- c. Safety valves should be monitored regularly.
- d. Workers should be trained properly to fight against emergency.
- e. Workers should be provided with aprons, radiation shield dresses.

45. Why residential quarters are not constructed nearer to Atomic Power Plants?

- a. Exposure to atomic radiation will affect human health.
- b. Radioactive pollution will affect the cells of the human body.
- c. Rescue operation is difficult in case of emergency.

EXPENDATURE DETILS

EXPENDATURE DETILS :

S.NO	PARTICULARS	QTY	AMOUNT	TOTAL
1.	ESP8266	1	1000	1000.00
2.	Humidity Sensor	1	700	700.00
3.	Temperature Sensor	1	700	700.00
4.	voltage regulator	1	200	200.00
5.	Gas Sensor	1	700	700.00
6.	Adrino software	1	1200	3200.00
7.	Pcb Board	1	500	500.00
8.	Helmet	1	1000	1000.00
9.	Connecting wires	-	300	300.00
10.	Connectors	-	200	200.00
11.	power supply components	-	500	500.00
12.	Other Components	-	3000	3000.00

TOTAL – 12,000/-

ADDRESS FOR COMMUNICATION

ADDRESS FOR COMMUNICATION

1) **BH. P. Krishanm RAJU**

S/O: Bh. V. Subramabnam Raju

D.NO: 8-3-99,

GAJULA STREET,

YANAM .

CELL.NO : 8639109466

EMAIL: chinni76590@gmail.com

2) **K.V.S.S.NAGENDRA**

S/O : K . Srinubabu,

D.NO: 4-11-002,

G.M.C Bala Yogi street,

YANAM,

CELL.NO:9515666427

EMAIL: @gmail.com

3) **P. NAVEEN**

S/O: P. Bhyravaswamy,

D.NO: 1-5-014,

GREAMPETA,

YANAM,

CELL.NO: 9010552199

EMAIL: naveenpalepu27@gmail.com

4) **P.JAGADHISH VARMA**

D/O: P. Srinavas Rao,

D.NO: 7-14-68/1,

K.V.R Nagar ,

YANAM,

CELL.NO:8367729795

EMAIL: pjvarma831@gmail.com

5) **P.D.K.S.S.ANUDEEP**

S/O: P. RAMAKRISHNA,

D.NO: 7-14-040,

THOTA STREET,

YANAM,

CELL.NO:9705064628

EMAIL: kasianudeep@gmail.com

-----THE END-----