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Smart Sensor Helmet

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ABSTRACT

Nowadays, advanced transportation technology and due to rise in the total number of vehicles, road accidents increases rapidly. At the same time, this advanced technology also increased the traffic hazards. Two wheelers accounts for 25% of total road accidents. Hence the ratio of road crashes that take place often increases causing immense loss of life due to poor emergency facilities. This paper provides an intelligent system to avoid two wheeler accidents and detection for human life safety. This proposed system includes a helmet controlled safety system where in the motorcycle ignition is enabled only when the helmet is put on and if a driver consumed alcohol is detected from the riders breath .We have used a pressure switch and a alcohol sensor for this purpose .In addition to this we have also proposed a mechanical locking system which prevents the use of kick start mechanism. A 315 MHz Radio Frequency Module as wireless link which able to communicate between transmitter circuit and receiver circuit. We have also used Arduino microcontroller to control the entire components in the system. Only when the rider put on the helmet then only the motorcycle's engine will start.

I. INTRODUCTION

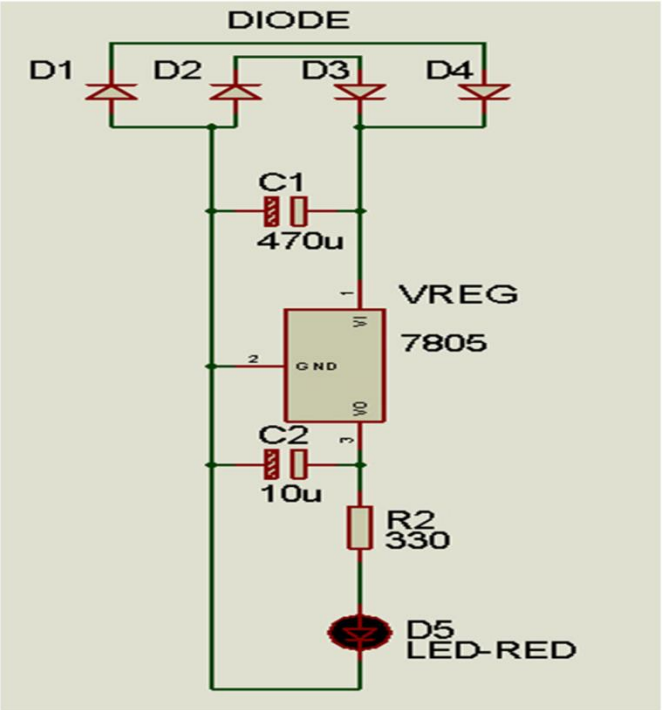
In India, there is one death occur for every 4 hours due to road accidents. The total number of road accidents increased by 2.5 percent from 4,89,400 in 2014 to 5,01,423 in 2015. The main reason behind these accidents is carelessness and fault of the driver and it has been revealed as the single most responsible factor for road accidents, killings, and injuries on all roads in the country over a long period. In India, 377 people die every day due to road accident which is four times more than the annual death toll from terrorism. Among these two wheelers account for one fourth of total road crash deaths. Predictably most of those who die on roads perish because of preventable causes: drunken drive, speeding and overloading. In recent times, helmets have been made compulsory. Traffic accidents in India increases every year. According to Section129 of Motor Vehicles Act, 1988 makes it compulsory for every single riding a two-wheeler to wear helmet following to the standards of the BIS (Bureau of Indian Standards). In India, drunken driver case is a criminal offence. As a drunken driver is a potential murderer, he cannot perform his tasks without risks and endangers road safety. 70 percent of road crashes in India are due to

drunken driving. Hence Road Safety becomes a major issue of concern, Therefore it is necessary to implement such a technique which is not easy to bypass the basic rule of wearing helmet and to avoid drunken driving. In this work, a system is designed which detects alcohol and helmet before engine of the bike is turned on.Helmet use consistently has been shown to reduce motorcycle crash–related injuries and deaths. Universal helmet laws requires all motorcyclists to wear helmets whenever they ride. For helmet detection pressure switch is used, the switch will be closed if helmet is worn. The communication between the helmet and the microcontroller is using RF module. The output of the switch will be given to the RF transmitter and the data will be transmitted.

The RF receiver received thetransmitted data, which is connected to the microcontroller for processing. Alcohol sensor is used as breath analyzer which is used to continuously monitor the rider's breathe and check if it is below the permissible level. MQ-3 sensor is used for this purpose. The engine of the two-wheeler is turned on using the relay. The relay is programmed to be turn on only when these two conditions are satisfied. Also a mechanical lock will be opened only when these two conditions are satisfied Arduino ATMEGA328p is used as microcontroller. The main aim of this paper is focused to prevent and reduce the death rate of two wheeler accidents.

II. HARDWARE IMPLEMENTATION POWER SUPPLY

There are many types of power supply. Most are designed to convert the Voltage AC Mains electricity to a suitable low voltage supply for electronic Circuits and other Devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. Here the AC supply main is given to the step down transformer. The transformer having the different voltages.

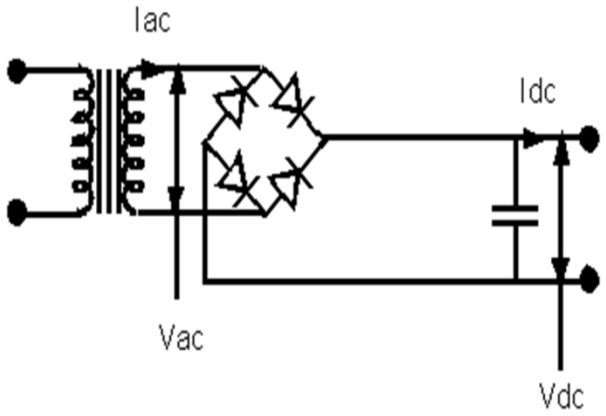


Circuit Diagram of Regulated Power Supply

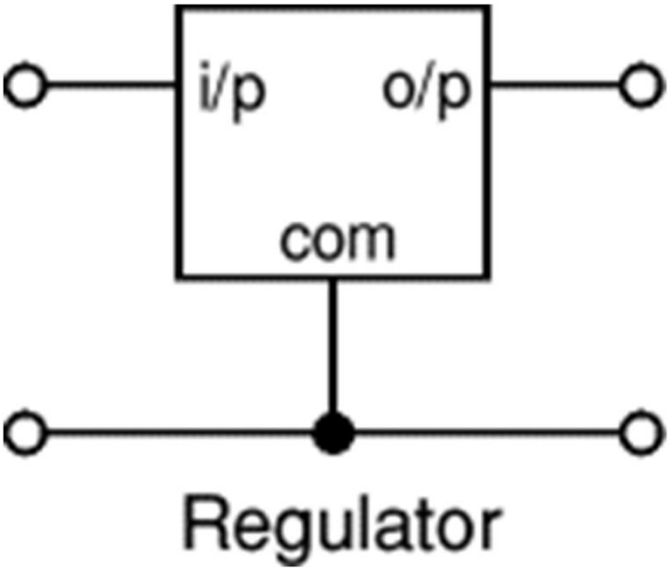
The output of transformer is given to the rectifier circuit. In this rectifier circuit, the AC voltage is converted to DC voltages. The rectified DC voltage is given to the regulator circuit. The output of the regulator depends upon the regulator IC chosen in the circuit.

III. BRIDGE RECTIFIER

A bridge rectifier can be madeby using four individual diodes, but it is also available in special packages containing the four diodes required. It is known as a full-wave rectifier. Smoothing is performed by a large value electrolytic capacitor connected across the DC Supply to act as a reservoir, supplying current to the output when the varying DC Voltage from the rectifier is falling



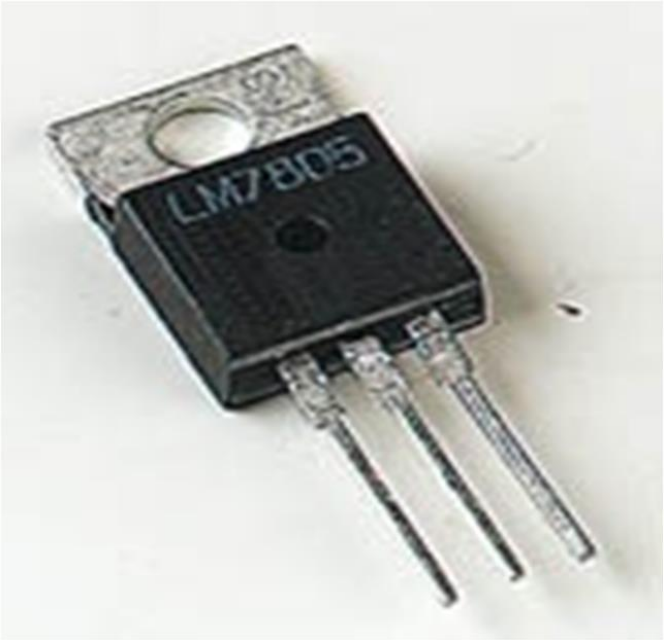
Bridge Rectifier



Regulator

The fig 3.2 shows the unsmoothed DC, smoothed DC by the filter capacitors. The capacitor charges quickly near the Peak of the varying DC, and then discharges as it supplies current to the output.

Note that smoothing significantly increases the average DC voltage to almost the peak Value (1.4-× RMS value). For example, 6V RMS AC is rectified to full wave DC of about 4.6V RMS (1.4V is lost in the bridge rectifier), with smoothing this increases to almost The peak value giving 1.4 × 4.6 = 6.4V smooth DC. Smoothing is imperfect due to the capacitor voltage falling a little as it discharges, Giving a small ripple voltage. For many circuits a ripple which is 10% of the supply Voltage is satisfactory and the equation below gives the required value for the Smoothing capacitor. A larger capacitor will give less ripple. The capacitor value must be doubled when smoothing half-wave DC.

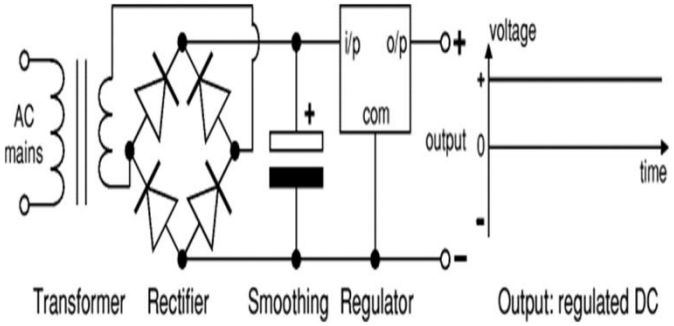


Regulator IC

IV. REGULATOR

Voltage regulators ICs are available with fixed (typically 5, 12 and 15V) or variable Output voltages. They are also rated by the maximum current they can pass. Negative Voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current ('overload protection') and Overheating ('thermal protection').

Many of the fixed voltage regulator ICs has 4 leads and look like power transistors, Such as the 7805 +5V 1A regulator shown on the right. If necessary, they include a hole for attaching a heat sink .

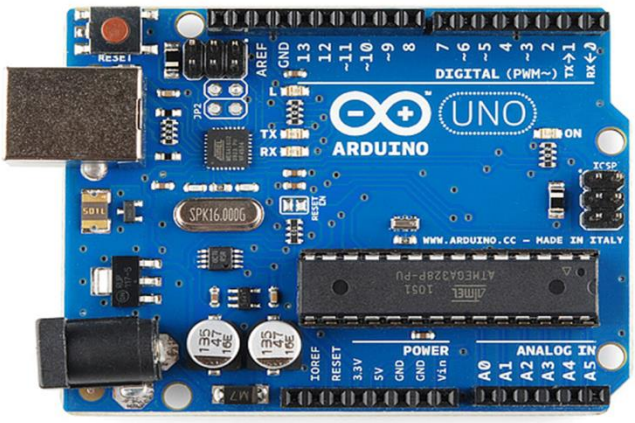


Rectifier Circuit Diagram and Waveform

The above fig 3.5 shows the rectifier circuit diagram and the regulated output voltage. The regulated DC output is very smooth without any ripple. In generally, two types of regulators are used. Namely, the positive and negative type regulators. For positive type regulators 78** series of regulators are used. For negative type regulators 79** series of regulators are used. Depends upon the voltage and type of the voltage the regulator IC is selected.

V. ARDUINO INTRODUCTION

Arduino is an open-source platform used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on your computer, used to write and upload computer code to the physical board. The Arduino platform has become quite popular with people just starting out with electronics, and for good reason. Unlike most previous programmable circuit boards, the Arduino does not need a separate piece of hardware (called a programmer) in order to load new code onto the board – we can simply use a USB cable. In Addition to that, the Arduino IDE uses a simplified version of C++, making it easier to learn to program. Finally, Arduino provides a standard form factor that breaks out the functions of the micro-controller into a more accessible package.



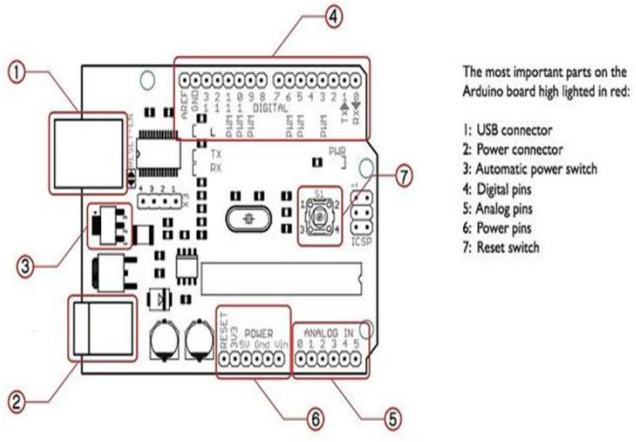
Arduino Uno

Microcontroller	ATmega428
Operating Voltage	5V
Input Voltage (recommended)	7-12V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 mA
DC Current for 4.4V Pin	50 Ma
Flash Memory	42 KB (ATmega428) of which 0.5 KB used by boot loader
SRAM	2 KB (ATmega428)
EEPROM	1 KB (ATmega428)
Clock Speed	16 MHz

Arduino Summery

VI. ARDUINO PIN DIAGRAM

A typical example of Arduino board is Arduino Uno. It consists of ATmega428- a 28 pin microcontroller.Arduino Uno consists of 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button



Arduino Pin Diagram

VII. POWER (BARREL JACK)

Arduino can be power either from the pc through a USB or through external source like adaptor or a battery. It can operate on a external supply of 7 to 12V. Power can be applied externally through the pin Vin or by giving voltage reference through the IORefpin..In the picture above the USB connection is labeled **(1)** and the barrel jack is labeled **(2)**.
The USB connection is also how you will load code onto your Arduino board. The recommended voltage for most Arduino models is between 6 and 12 Volts.

VIII. PINS (5V, 4.4V, GND, ANALOG, DIGITAL, PWM, AREF)

The pins on your Arduino are the places where you connect wires to construct a circuit probably in conjunction with a breadboard and some wire. They usually have black plastic 'headers' that allow you to just plug a wire right into the board. The Arduino has several different kinds of pins, each of which is labeled on the board and used for different functions.

- **GND** :
  Short for 'Ground'. There are several GND pins on the Arduino, any of which can be used to ground your circuit.

- **5V & 4.4V** :
  As you might guess, the 5V pin supplies 5 volts of power, and the 4.4V pin supplies 4.4 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 4.4 volts.

- **Analog (5)**:
  The area of pins under the 'Analog In' label (A0 through A5 on the UNO) are Analog In pins. These pins can read the signal from an analog sensor (like a temperature sensor) and convert it into a digital value that we can read.

- **Digital (4)**:
  Across from the analog pins are the digital pins (0 through 14 on the UNO). These pins can be used for both digital input (like telling if a button is pushed) and digital output (like powering an LED).

- **PWM** :
  You may have noticed the tilde (~) next to some of the digital pins (4, 5, 6, 9, 10, and 11 on the UNO). These pins act as normal digital pins, but can also be used for someothercalled Pulse-Width Modulation (PWM). We have a tutorial on PWM, but for now, think of these pins as being able to simulate analog output (like fading an LED in and out).

- **AREF** :
  Stands for Analog Reference. Most of the time you can leave this pin alone. It is rarely used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.

IX. RESET BUTTON

Just like the original Nintendo, the Arduino has a reset button **(7)**. Pushing it will temporarily connect the reset pin to ground and restart any code that is loaded on the Arduino. This can be very useful if your code doesn't repeat, but you want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino doesn't usually fix any problems.

X. POWER LED INDICATOR

Just beneath and to the right of the word "UNO" on your circuit board, there's a tiny LED next to the word 'ON' . This LED should light up whenever you plug your Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong. Time to re-check your circuit!

XI. TX RX LEDS

RX is short for receive,TX is short for transmit. These markings appear quite a bit in electronics to indicate the pins responsible for serial communication. In our case, there are two places on the Arduino UNO where TX and RX appear – once by digital pins 0 and 1, and a second time next to the TX and RX indicator LEDs **(12)**. These LEDs will give us some nice visual indications whenever our Arduino is receiving or transmitting data (like when we're loading a new program onto the board).

XII. MAIN IC

Think of it as the brains of our Arduino. The main IC on the Arduino is slightly different from board type to board type, but is usually from the ATmega line of IC's from the ATMEL company. This can be important, as you may need to know the IC type (along with your board type) before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC. If you want to know more about the difference between various IC's, reading the datasheets is often a good idea.

XIII. VOLTAGE REGULATOR

The voltage regulator **(4)** is not actually something you can (or should) interact with on the Arduino. But it is potentially useful to know that it is there and what it's for. The voltage regulator does exactly what it says – it determines the amount of voltage that is let into the Arduino board. Think of it as a kind of gatekeeper; it will turn away an extra voltage that might harm the circuit. Of course, it has its limits, so don't hook up your Arduino to anything greater than 20 volts .

XIV. 3.3 GEAR MOTOR

"Gear motor" refers to a combination of a motor plus a reduction geartrain. These are often conveniently packaged together in one unit. The gear reduction (gear train) reduces the speed of the motor, with a corresponding increase in torque. Gear ratios range from just a few (e.g. 3) to huge (e.g. 500). A small ratio can be achieved with a single gear pair, while a large ratio requires a series of gear reduction steps and thus more gears. There are a lot of different kinds of gear reduction. In the case of a small transmission ratio N, the unit may be backdrivable, meaning you can turn the output shaft, perhaps by hand, at angular velocity w and cause the motor to rotate at angular velocity Nw. A larger transmission ratio N may make the unit non-back drivable. Each has advantages for different circumstances. Back drivability depends not just on N, but on many other factors. For large N, often the maximum output torque is limited by the strength of the final gears, rather than by N times the motor's torque. In our project we have used a 12 v 30 RPM DC gear motor for the kicker locking operation.

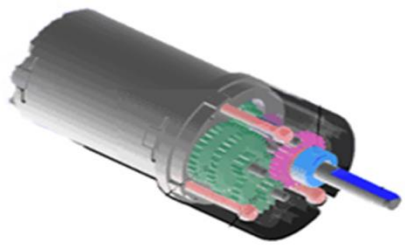


Fig :12v DC Gear Motor

Gearing can help a drive system to manage the right balance between speed and torque. They are able to convert a high speed, low torque motor (such as an electric DC motor) into a low speed, high torque output (or vice versa). A good analogy in electrical engineering is the transformer - just replace voltage with torque and current with speed. Gears will allow you to carry far more load, but at a sacrifice to speed -

inversely proportional, e.g. a doubling of torque comes with a halving in speed.
Like with a transformer, the total energy of the (idealised) system is conserved with torque*speed always equaling to a constant number (assuming constant motor output). However, in real life you will not achieve 100% efficiency, so that must also be taken into account. The level of efficiency depends mainly on the friction of the bearings.

Motors are also often more efficient at a certain speed, which can allow you to extract more energy from the electrical input by matching the motor maximum efficiency speed with the torque requirements to achieve a higher speed than a differently (or not at all) geared system.

Electric DC motors nearly always rotate at far too high speeds and have too little torque for usability without any gearing, so you will need some sort of gearing - the exact ratio will depend on the above mentioned points. If the vehicle is large enough and heavy enough, and/or is required to operate efficiently at different speeds, you may even want to look into a multi-speed gearbox (be careful with this though, as the added weight and complexity can cause major problems).

Generally, the way to decide on the correct gear ratio/s is by the following process:

1. What is the speed requirement? Divide by wheel circumference to find wheel rotation speed (make sure to keep correct units - rpm or rps is standard).
2. Find ideal motor rotation speed for maximum efficiency/maximum output/combination of both.
3. Divide the motor rotation speed by the wheel rotation speed to find the gear ratio required.
4. For the vehicle speed/s required, check the gear ratio derived against the motor efficiency and torque curves and if there are any major efficiency losses or insufficient torques, you may need to change the gear ratio or switch to a multi-speed gearbox. This process is generally iterative.

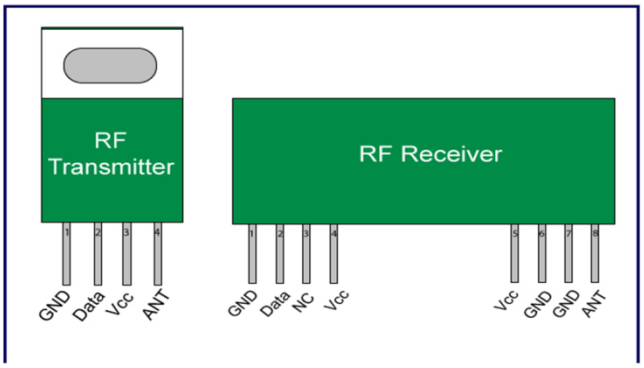
To add it all up, gears are almost essential for an electric DC motor. The exact gear ratio/s are what is important to find. In a solar powered vehicle, efficiencies are even more important, so correct gear ratio/s can give a massive merit - but done incorrectly, they can be detrimental (as with most systems). You cannot however achieve a higher speed and torque simultaneously, as that requires more energy - totally dependent on the motor itself. You can however get greater efficiencies, which is similar in effect.

RF module

As the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This type of modulation is known as Amplitude Shift Keying (ASK). Transmission via RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suit for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is stronger and reliable than IR transmission. RF communication uses a unique frequency unlike IR signals which are affected by other IR emitting sources.This **RF module** consists of an **RF Transmitter** and an **RF Receiver**. The transmitter/receiver (Tx/Rx) pair operates at a frequency of **434 MHz**. An RF transmitter receives serial data and transmits it wirelessly via RF through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps.The RF receiver received transmitted data operating at the same frequency as that of the transmitter. The RF module is often used along with a

pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D, HT640-HT648, etc. are some commonly used encoder/decoder pair ICs.

XV. PIN DIAGRAM:



Pin Description:

RF Transmitter

PIN NO	FUNCTION	NAME
1	Ground (0V)	Ground
2	Serial data input pin	Data
3	Supply voltage	5V Vcc
4	Antenna output pin	ANT

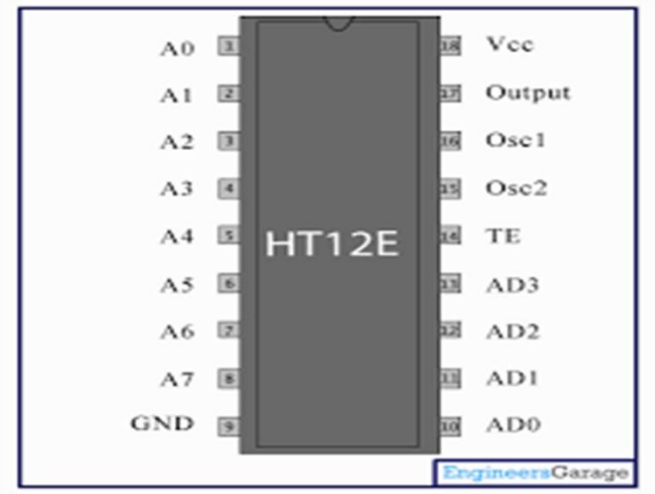
RF Receiver

PIN NO	FUNCTION	NAME
1	Ground(0V)	Ground
2	Serial data output pin	Data
3	Linear output pin	Not connected NC
4	Supply voltage	5V Vcc
5	Supply voltage	5V Vcc
6	Ground (0V)	Ground
7	Ground(0V) Ground 8 antenna input pin	ANT

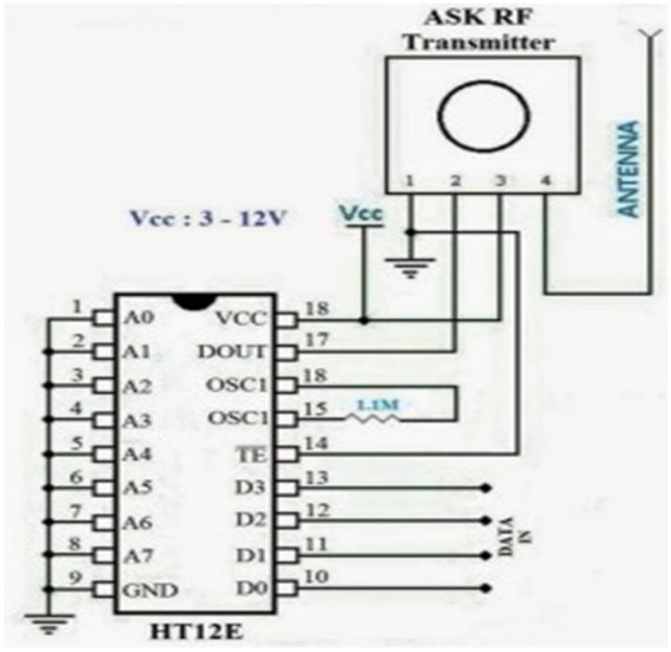
XVI. HT12E ENCODER

HT12E is an **encoder integrated circuit** of 212 series of encoders. They are paired with 212 series of decoders for use in remote control system applications. It is mainly used in interfacing RF and infrared circuits. The chosen pair of encoder/decoder should have same number of addresses and data format. Simply put, HT12E converts the parallel inputs into serial output. It encodes the 12 bit parallel data into serial for transmission through an RF transmitter. These 12 bits are divided into 8 address bits and 4 data bits. HT12E has a transmission enable pin which is active low. When a trigger signal is received on TE pin, the programmed addresses/data are transmitted together with the header bits via an RF or an infrared transmission medium. HT12E begins a 4-word transmission cycle upon receipt of a transmission enable. This cycle is repeated as long as TE is kept low. As soon as TE returns to high, the encoder output completes its final cycle and then stops.

Pin Diagram:



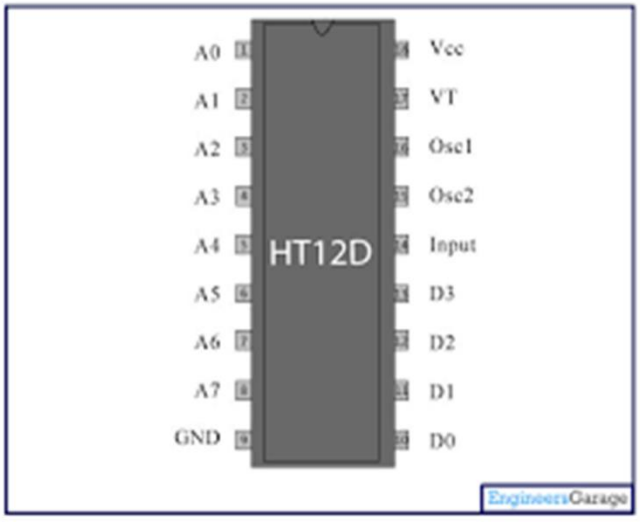
XVII. CIRCUIT CONNECTION OF HT12E ENCODER

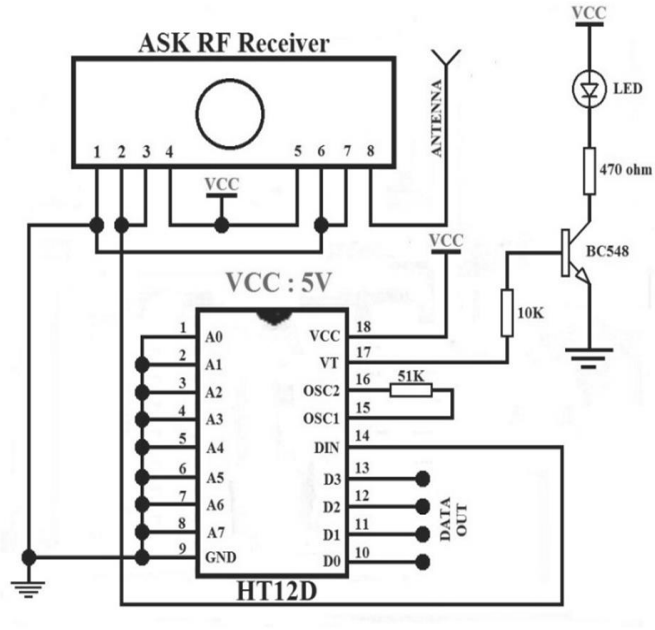


XVIII. HT12D DECODER

HT12D is a decoder integrated circuit that comes under 212 series of decoders. This series of decoders are mainly used for remote control system applications, like burglar alarm, car door controller, security system etc. It is mainly provided to interface RF and infrared circuits. They are paired with 212 series of encoders. The chosen pair of encoder/decoder should have same number of addresses and data format.In simple terms, HT12D converts the serial input into parallel outputs. It decodes the serial addresses and data received by, say, an RF receiver, into parallel data and sends them to output data pins. The serial input data is compared with the local addresses three times continuously. The input data code is decoded when no error or unmatched codes are found. A valid transmission in indicated by a high signal at VT pin. HT12D is capable of decoding 12 bits, of which 8 are address bits and 4 are data bits. The data on 4 bit latch type output pins remain unchanged until new one is received.

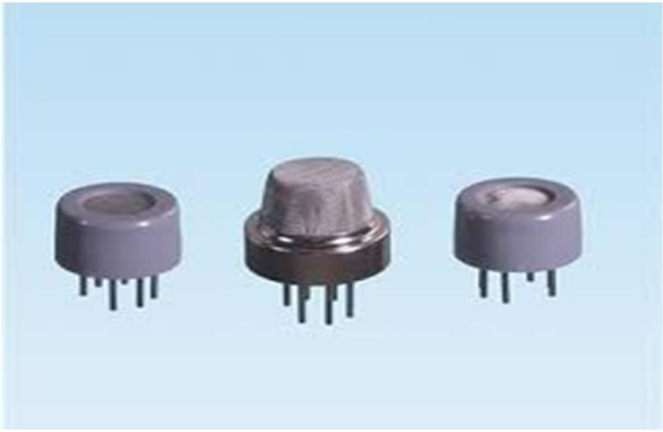
PIN DIAGRAM:





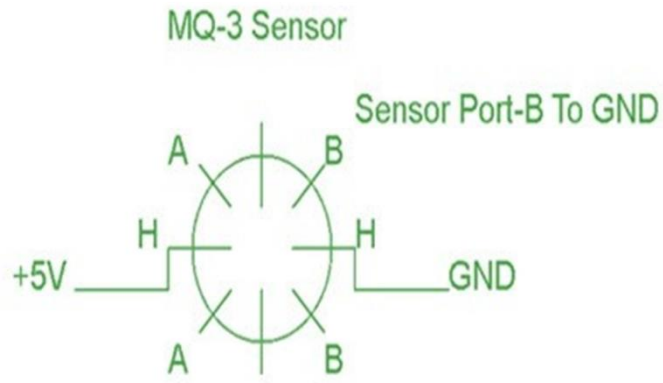
XIX. ALCOHOL SENSOR

An alcohol sensor detects the attentiveness of alcohol gas in the air and an analog voltage is an output reading. The sensor can activate at temperature ranging between -10 and 50° C with a power supply is less than 150 Ma to 5V. The sensing range is from 0.04 mg/L to 4 mg/L, which is suitable for breathalyzers.



MQ-3 alcohol senosor

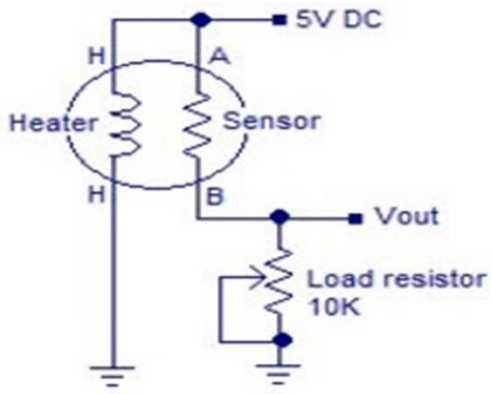
The MQ-3 alcohol gas sensor comprises of total 6-pins including A, H, B and the other three pins are A, H, B out of the total 6-pins we use only 4 pins. The two pins A, H are used for the heating purpose and the other two pins are used for the ground and power. There is a heating system inside the sensor, which is made up of aluminium oxide, tin dioxide. It has heat coils to produce heat, and thus it is used as a heat sensor. The below diagram shows the pin diagram and the configuration of the MQ-3 alcohol sensor.



Pin diagram

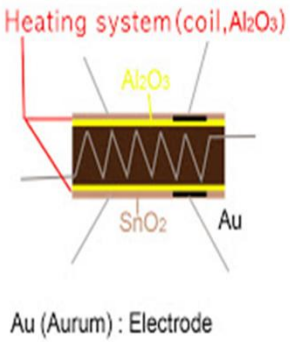
Working Principle And Circuit Diagram

The MQ-135 alcohol sensor consists of a tin dioxide (SnO2), a perspective layer inside aluminium oxide micro tubes (measuring electrodes) and a heating element inside a tubular casing. The end face of the sensor is enclosed by a stainless steel net and the back side holds the connection terminals. Ethyl alcohol present in the breath is oxidized into acetic acid passing through the heat element. With the ethyl alcohol cascade on the tin dioxide sensing layer, the resistance reduces. By using the external load resistance, the resistance variation is converted into a suitable voltage variation. The circuit diagram and the connection arrangement of an MQ 135 alcohol is shown below.



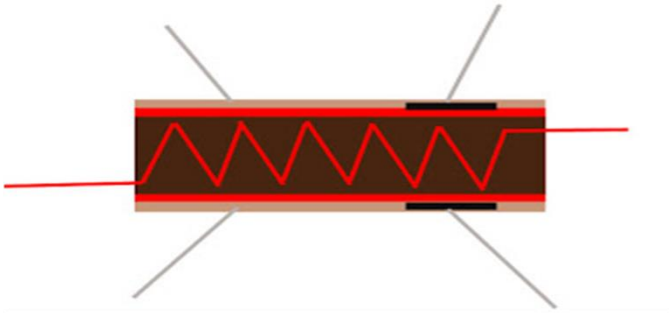
Circuit diagram

The core system is the cube. As you can see in this cross-sectional view, basically, it is an Alumina tube cover by SnO2, which is tin dioxide. And between them there is an Aurum electrode, the black one. And also you can see how the wires are connected. So, why do we need them? Basically, the alumina tube and the coils are the heating system, the yellow, brown parts and the coils in the picture.



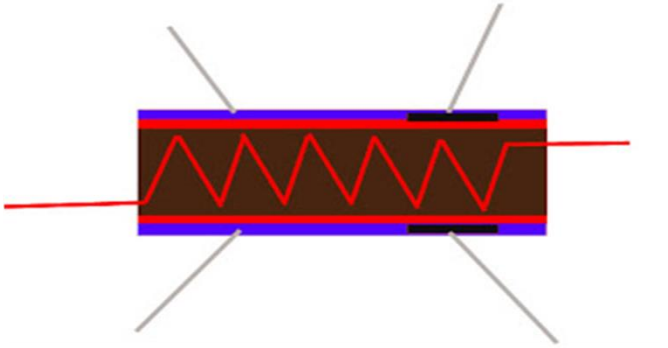
Working Process :

If the coil is heated up,



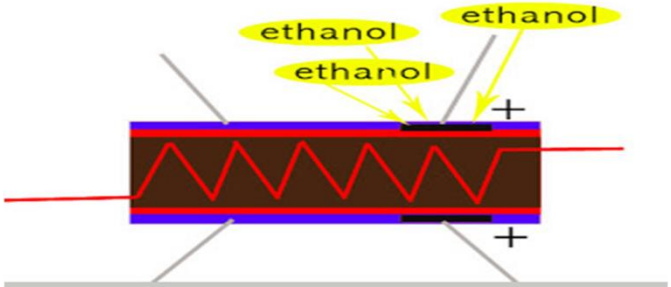
If coil is heated,

SnO_2 ceramics will become the semi - conductor, so there are more movable electrons, which means that it is ready to make more current flow.



SnO_2 ceramics will be becoming the semi-conductor.

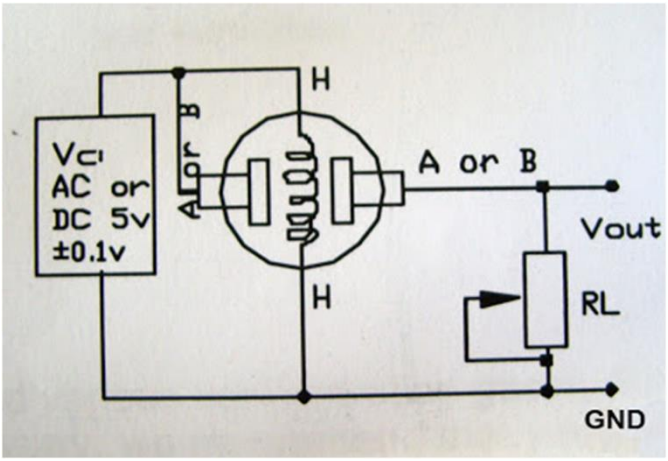
Then, when the alcohol molecules in the air meet the electrode that is between alumina and tin dioxide, ethanol burns into acetic acid then more current is produced. So the more alcohol molecules there are, the more current we will get. Because of this current change,we get the different values from the sensor.

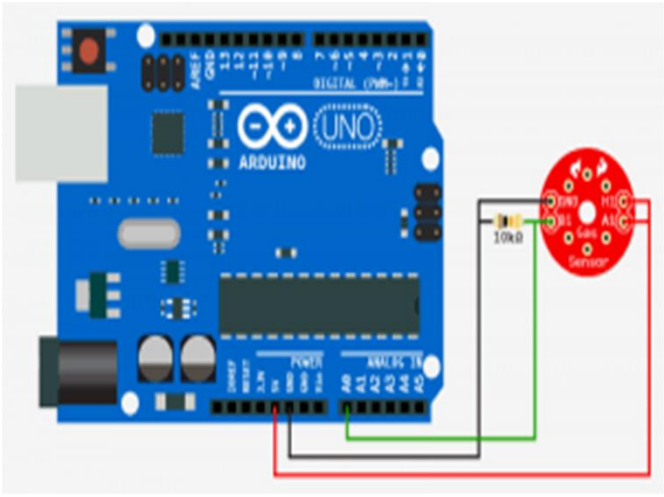


When alcohol meets the electrode, it is burnt into acetic acid then more current is produced.

Microcontroller Connections

Here is the schematic. It is pretty simple. First, you can use 5v. And as you can see one of H pins goes to the power and the other one is connected to the ground. And the pin A is connected between the power and the pin H and the pin B is goes to the microcontroller. Also between the ground and the Arduino, you need the resistor. Before you connect the resistor if you use the pot, you can tune the resistor for getting more accurate values. In the datasheet they say you can used 100k om to 470k om.





XX. LIMIT SWITCH

Presence Sensing is the act of detecting the presence or absence of an object with a contact or non-contact sensing device. The sensors then produce an electrical output signal that can be used to control equipment or processes. Limit switches are a type of sensor that

detect presence and absence. Specifically, mechanical limit switches are switches that are mechanically activated, meaning that they have some sort of arm, lever, knob, plunger, etc., which is physically—or mechanically—activated by making contact with another object. As the object makes contact with the actuator of the switch, it eventually moves the actuator to its "limit" where the contacts change state. Other varieties of sensors/switches exist, including proximity sensors, light sensors, electric switches, among others.In our project we have used a push as an alternative for limit switch because it also works on the same principle and also it I compact in size so that it fits easily inside a helmet

Fig 1:Limit switch(push button)

Mechanical limit switches are contact sensing devices widely used for detecting the presence or position of objects in industrial applications. The term limit switch is derived from the operation of the device it-self. As an object (or target) makes contact with the operator of the switch, it eventually moves the actuator to the "limit "where the electrical contacts change state. Through this mechanical action, electrical contacts are either opened (in a normally closed circuit) or closed (in abnormally open circuit). Inductive proximity, capacitive proximity, and photoelectric sensors perform this same process through noncontact sensing. In its simplest form, a limit switch is a "switch" that can be mounted into remote locations so that it is actuated by an object other than a human operator.

Some basic functions of limit switches are:

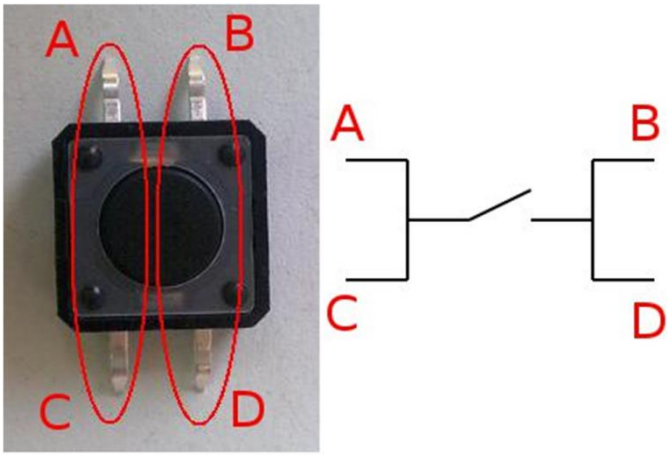
- Detecting presence/absence
- Counting
- Detecting range of movement
- Detecting positioning & travel limit
- Breaking a live circuit when unsafe conditions arise
- Detecting speed

…and hundreds of other applications

Mechanical limit switches can be found in any industrial or commercial application where detection or safety is needed. Limit switches are a practical solution for sensing in most situations.

XXI. WORKING

Pushbutton usually have four legs. Anyway, as you can see from the picture below, legs are always connected in groups of two. When the pushbutton is pressed all the 4 legs are connected.



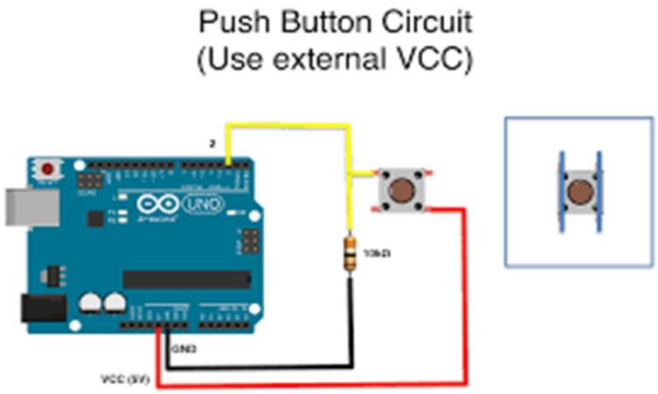
Pin diagram

XXII. CIRCUIT CONNECTION

The pushbutton is a component that connects two points in a circuit when you press it. The example turns on an LED when you press the button. We connect three wires to the Arduino board. The first goes from one leg of the pushbutton through a pull-up resistor (here 2.2 KOhms) to the 5 volt supply. The second goes from the corresponding leg of the

pushbutton to ground. The third connects to a digital i/o pin which reads the button's state.

When the pushbutton is open (unpressed) there is no connection between the two legs of the pushbutton, so the pin is connected to 5 volts (through the pull-up resistor) and we read a HIGH. When the button is closed (pressed), it makes a connection between its two legs, connecting the pin to ground, so that we read a LOW. (The pin is still connected to 5 volts, but the resistor in-between them means that the pin is "closer" to ground.)



Circuit connection

XXIII. CONCLUSION

The results of this project have proved that the motorcycle's engine will only start is the helmet is worn and the belt has been buckled. So, it will reduce the impact from accident and the kick start locking mechanism was also implemented this can prevent motorcycles from being stolen. Arduino Controller is good incontrolling all sensors and the system. Implementing the wireless module which is 315 MHz Radio Frequency Moduleto transmit signal from helmet to the motorcycle improved the capability of transmitting data.

XXIV. REFERENCES

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