

AUTOMATIC LICENSE APPROVAL SYSTEM

Submitted in partial fulfillment of the requirements for the award of

Bachelor of Engineering Degree in
Electrical and Electronics Engineering

By

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

SCHOOL OF ELECTRICAL AND ELECTRONICS ENGINEERING

SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY

(DEEMED TO BE UNIVERSITY)

Accredited with Grade "A" by NAAC

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MAY 2022



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DEPARTMENT OF ELECTRICAL AND ELECTRONICAL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of MONISHA M (Reg. No. 38140030) and NANDHINI D (Reg. No. 38140035) who carried out the project entitled "AUTOMATIC LICENSE APPROVAL SYSTEM" under our supervision from December 2021 to May 2022.

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Head of the Department

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Submitted for Viva voce Examination held on_____

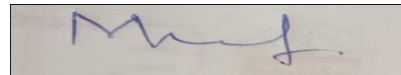
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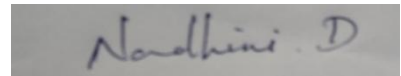
We MONISHA M (Reg. No. 38140030) and NANDHINI D (Reg. No. 38140035) hereby declare that the Project Report entitled “**AUTOMATIC LICENSE APPROVAL SYSTEM**” done by me under the guidance of Dr. D. SUSITRA is submitted in partial fulfillment of the requirements for the award of Bachelor of Engineering / Technology degree in Electrical and Electronics Engineering.

1.



DATE: 20.04.2022

2.



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SIGNATURE OF THE CANDIDATE

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ABSTRACT

In this paper, we proposed a crowd-sensing idea to construct the driving environment so that the driver could have better understanding of his/her surroundings on the roadway. We assume that intelligent vehicles will embed a sensing system. We assume that intelligent vehicles will embed a sensing system, which is consists of accelerometer sensor, PIC 16F877A, switches, RFID reader. The user scan their RFID card with help of RFID reader and then its shows their respective aadhar cards. The key is used to starts the vehicle and switches are pressed by the user. The accelerometer sensor senses the user correctly follow the rules (eight direction) or not. If the user removed their leg from the pedal or not follow the rules of RTO. The user may mark as rejected by this system. Our system shows the status of user did while license testing and it showed in the LCD display and buzzer will alert.

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AUTOMATIC LICENSE APPROVAL SYSTEM

CHAPTER – 1

INTRODUCTION

1.1 GENERAL

Despite continued efforts made by the different state governments in India, various international and national organizations continue to highlight the fatalities on the roads caused by inconsistent process of issuing driving licenses across India. The independent survey conducted shows that close to 60 percent of license holders did not even have to take the driving license test and 54 percent of them were untrained to drive. The study also indicates that the corruption is focused on agents that work as intermediaries between the officials and citizens. Hence the only solution for this problem is to implement an efficient, transparent and cost effective driver testing system. The theoretical examination evaluates the candidate knowledge on different traffic signs, traffic regulation and also the basic understanding of simple safety check before using a vehicle. The practical examination comprises of two tests namely off-road test and on-road test. The off road test is for examining the candidate's ability in controlling the vehicle. The on-road test is conducted in light traffic on normal road. Normally, the on-road test is carried out after completing off-road test. The off-road test tracks are of three types – H, S and 8 shaped tracks. In India, the test track adopted for off-road test purpose varies from state to state.

An embedded system is a special-purpose computer system designed to perform one or a few dedicated functions, sometimes with real-time computing constraints. It is usually embedded as part of a complete device including hardware and mechanical

parts. large stationary installations like traffic lights, factory controllers, or the systems controlling nuclear power plants.

Complexity varies from low, with a single microcontroller chip, to very high with multiple units, peripherals and networks. For example, Handheld computers share some elements with embedded systems —such as the operating systems and microprocessors which power them — but are not truly embedded systems, because they allow different applications to be loaded and peripherals to be connected.

Embedded systems that are programmable are provided with a programming interface, and embedded systems programming is a specialized occupation. However, some low-end consumer products use very inexpensive microprocessors and limited storage, with the application and operating system both part of a single program. The program is written permanently into the system's memory in this case, rather than being loaded into RAM (random access memory), as programs on a personal computer are.

CHAPTER – 2

LITERATURE SURVEY

1)Automated License Management System Using RFID[april -2016]

Normally, in license tests a candidate applied for license have to drive over a closed loop path like the number (8) in front of the authorities. The candidate has to drive over the path without any support over the land surface and if he fails to do he will be disqualified. For that, the authorities have to watch him/her manually. A system for watching the candidate whether he/she is eligible for getting license by using a load cell has been proposed here. The load cell changes its output when there is any pressure change over the surface. Thus the differential output from the load cell detects the candidate who fails to keep his/her foot in the vehicle while following the path. Then the differential output was processed by the micro-controller. The ultrasonic sensor is used for hand signal detection and finger print sensor is used for the number of attempts made by a person during license test and thereby automatically reject or pass status will be generated by the system.

EXISTING SYSTEM

In the present scenario, the candidates who have applied for driving license have to appear for a theoretical examination and a practical examination. The theoretical examination evaluates the candidate knowledge on different traffic signs, traffic regulation and also the basic understanding of simple safety check before using a vehicle. Different ways are adopted for the conduct of theoretical examination. These are oral examination, question paper or computer based examination. Theoretical examination is conducted before the practical examination. Pass in the theoretical examination is a prerequisite for the practical examination. The practical examination comprises of two tests namely off-road test and on-road test. The off road test is for examining the candidate's ability in controlling the vehicle. The on-road test is conducted in light traffic on normal road. Normally, the on-road test is carried out after completing off-road test. The off-road test tracks are of three types – H, Sand 8 shaped tracks. In India, the test track adopted for off-road test purpose varies from state to state.

CHAPTER – 3

SYSTEM DESIGN

PROPOSED SYSTEM

At present era in our country there are so many people who are not having their original driving license with them. Instead, they are maintaining fake license, due to this the ratio of accidents increasing day to day. **Triple Axis Accelerometer ADXL 335:** Breakout board for the 3 axis ADXL335 from Analog Devices. This is the latest in a long, proven line of analog sensors - The ADXL335 is a triple axis MEMS accelerometer with extremely low noise and power consumption - only 320uA. The sensor has a full sensing range of +/-3g. Board comes fully assembled and tested with external components installed. The included 0.1uF capacitors set the bandwidth of each axis to 50Hz. and onboard regulator 3.3volts. The accelerometer sensor recognizes the bike activity while push button pressing. If the sensor values exceeds the predefined threshold limits or leg removed from the push button, this system will consider as a license failed and status will be updated in the cloud through internet of things.

BLOCK DIAGRAM:

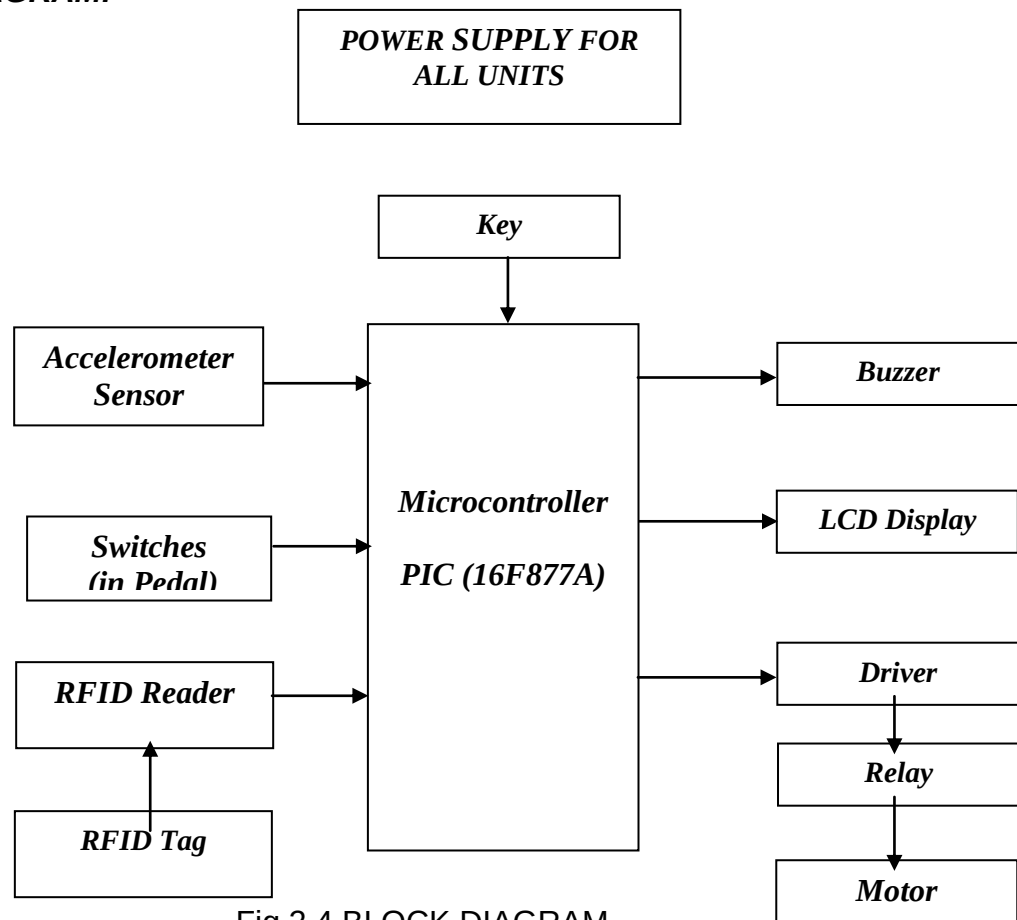


Fig.2.4 BLOCK DIAGRAM

CHAPTER - 4

DESCRIPTION OF HARDWARE COMPONENTS

POWER SUPPLY

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

Power supplies for electronic devices can be broadly divided into linear and switching power supplies. The linear supply is a relatively simple design that becomes increasingly bulky and heavy for high current devices; voltage regulation in a linear supply can result in low efficiency. A switched-mode supply of the same rating as a linear supply will be smaller, is usually more efficient, but will be more complex.

LINEAR POWER SUPPLY

An AC powered linear power supply usually uses a transformer to convert the voltage from the wall outlet (mains) to a different, usually a lower voltage. If it is used to produce DC, a rectifier is used. A capacitor is used to smooth the pulsating current from the rectifier. Some small periodic deviations from smooth direct current will remain, which is known as ripple. These pulsations occur at a frequency related to the AC power frequency (for example, a multiple of 50 or 60 Hz).

The voltage produced by an unregulated power supply will vary depending on the load and on variations in the AC supply voltage. For critical electronics applications a linear regulator will be used to stabilize and adjust the voltage. This regulator will also greatly reduce the ripple and noise in the output direct current. Linear regulators often provide current limiting, protecting the power supply and attached circuit from over current.

Adjustable linear power supplies are common laboratory and service shop test equipment, allowing the output voltage to be set over a wide range. For example, a bench power supply used by circuit designers may be adjustable up to 30 volts and

up to 5 amperes output. Some can be driven by an external signal, for example, for applications requiring a pulsed output.

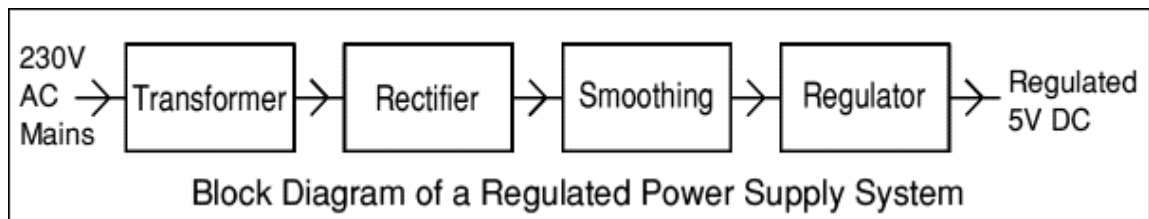


Fig 3.2 REGULATED POWER SUPPLY SYSTEM

Transformer:

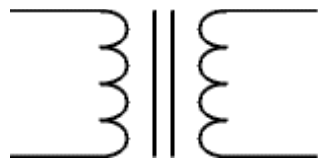


Fig 3.3 TRANSFORMER

Transformers convert AC electricity from one voltage to another with little loss of power. Transformers work only with AC and this is one of the reasons why mains electricity is AC.

Step-up transformers increase voltage, step-down transformers reduce voltage. Most power supplies use a step-down transformer to reduce the dangerously high mains voltage (230V in UK) to a safer low voltage. The input coil is called the primary and the output coil is called the secondary. There is no electrical connection between the two coils; instead they are linked by an alternating magnetic field created in the soft-iron core of the transformer. The two lines in the middle of the circuit symbol represent the core. Transformers waste very little power so the power out is (almost) equal to the power in. Note that as voltage is stepped down current is stepped up. The ratio of the number of turns on each coil, called the turn's ratio, determines the ratio of the voltages. A step-down transformer has a large number of turns on its primary (input) coil which is connected to the high voltage mains supply, and a small number of turns on its secondary (output) coil to give a low output voltage.

Turns ratio= $V_p/V_s=N_p/N_s$ and Power out=Power in

$$V_s \cdot I_s = V_p \cdot I_p$$

V_p = primary (input) voltage V_s = secondary (output) voltage
 N_p = number of turns on primary coil N_s = number of turns on secondary coil
 I_p = primary (input) current I_s = secondary (output) current

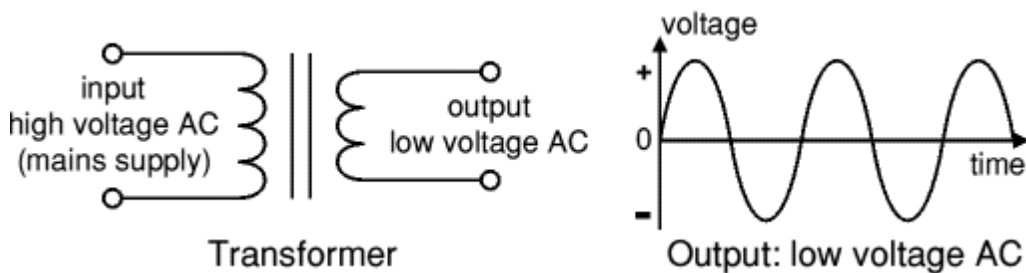


Fig 3.3 TRANSFORMER & LOW VOLTAGE

The low voltage AC output is suitable for lamps, heaters and special AC motors. It is not suitable for electronic circuits unless they include a rectifier and a smoothing capacitor.

Rectifier:

There are several ways of connecting diodes to make a rectifier to convert AC to DC. The **bridge rectifier** is the most important and it produces full-wave varying DC. A full-wave rectifier can also be made from just two diodes if a centre-tap transformer is used, but this method is rarely used now that diodes are cheaper. A **single diode** can be used as a rectifier but it only uses the positive (+) parts of the AC wave to produce half-wave varying DC.

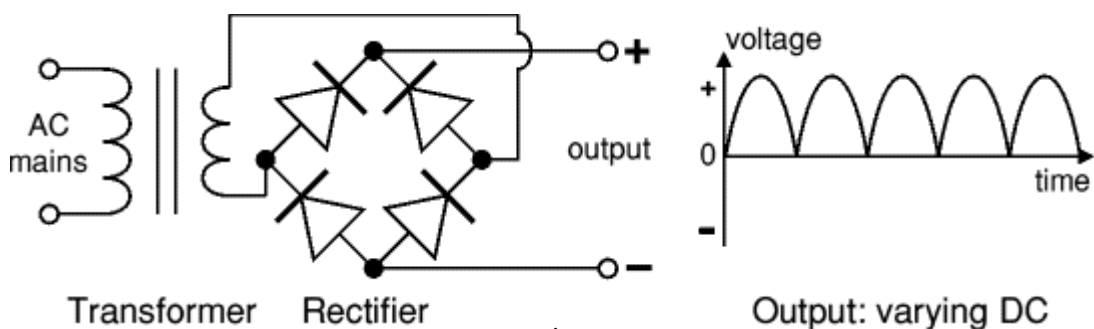


Fig 3.4 RECTIFIER

The varying DC output is suitable for lamps, heaters and standard motors. It is not suitable for electronic circuits unless they include a smoothing capacitor.

Bridge rectifier:

A bridge rectifier can be made using four individual diodes, but it is also available in special packages containing the four diodes required. It is called a full-wave rectifier because it uses the entire AC wave (both positive and negative sections). 1.4V is used up in the bridge rectifier because each diode uses 0.7V when conducting and there are always two diodes conducting, as shown in the diagram below. Bridge rectifiers are rated by the maximum current they can pass and the maximum reverse voltage they can withstand (this must be at least three times the supply RMS voltage so the rectifier can withstand the peak voltages). Please see the Diodes page for more details, including pictures of ridge rectifiers.

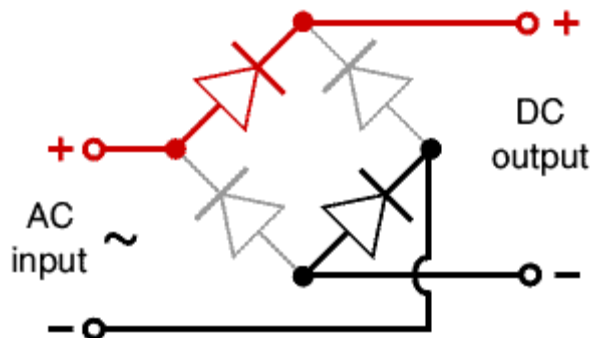


Fig 3.5 BRIDGE RECTIFIER

Alternate pairs of diodes conduct, changing over the connections so the alternating directions of AC are converted to the one direction of DC.

Output: full-wave varying DC: (using the entire AC wave):

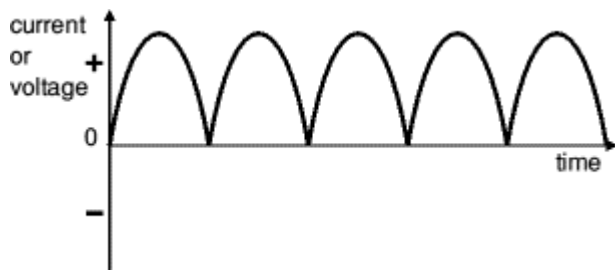
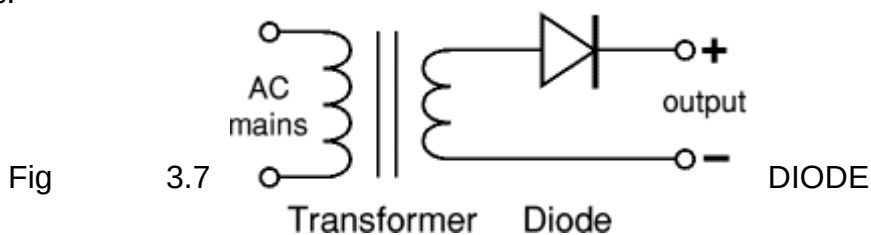


Fig 3.6 FULL WAVE

Single diode rectifier:

A single diode can be used as a rectifier but this produces **half-wave** varying DC which has gaps when the AC is negative. It is hard to smooth this sufficiently well to supply electronic circuits unless they require a very small current so the smoothing capacitor does not significantly discharge during the gaps. Please see the [Diodes](#) page for some examples of rectifier diodes.



Output: half-wave varying DC (using only half the AC wave):

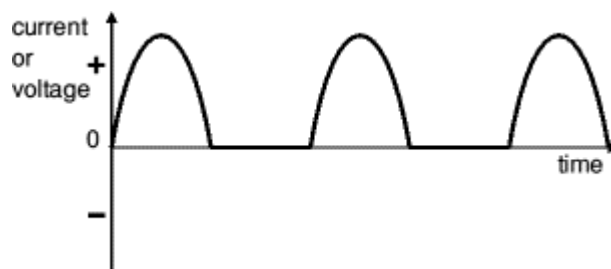


Fig 3.8 HALF WAVE

Smoothing:

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. The diagram shows the unsmoothed varying DC (dotted line) and the smoothed DC (solid line). The capacitor charges quickly near the peak of the varying DC, and then discharges as it supplies current to the output.

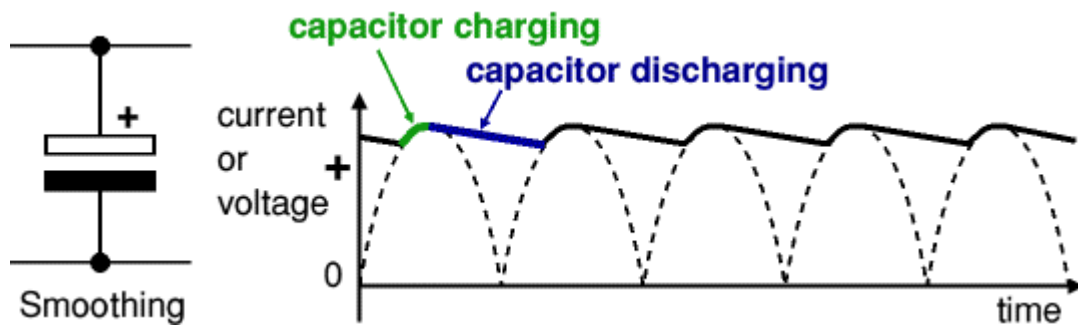


Fig 3.9 SMOOTHING

Note that smoothing significantly increases the average DC voltage to almost the peak value ($1.4 \times \text{RMS}$ 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 $1.4 \times 4.6 = 6.4\text{V}$ smooth DC.

Smoothing is not perfect 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 fewer ripples. The capacitor value must be doubled when smoothing half-wave DC.

Smoothing Capacitor for 10% ripple, $C = 5 \cdot I_o / V_s \cdot f$

C = smoothing capacitance in farads (F)

I_o = output current from the supply in amps (A)

V_s = supply voltage in volts (V), this is the peak value of the unsmoothed DC

f = frequency of the AC supply in hertz (Hz), 50Hz in the UK.

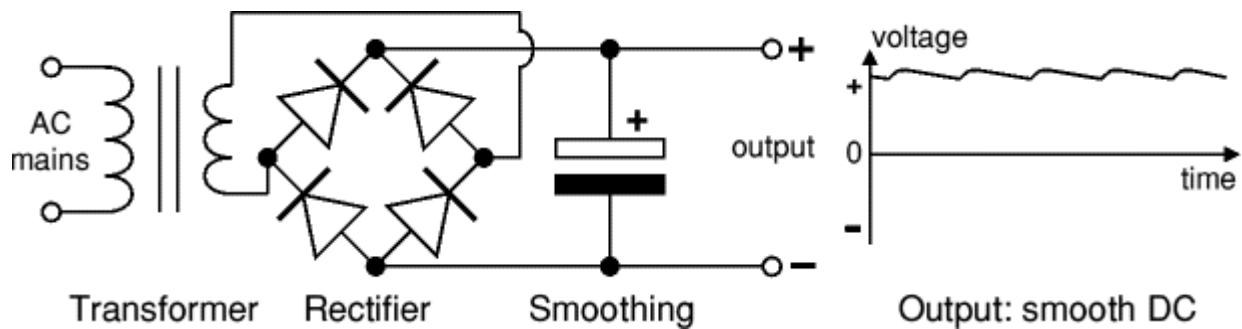


Fig 3.10 SMOOTHING

The smooth DC output has a small ripple. It is suitable for most electronic circuits.

Regulator:

Voltage regulator 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').

The LM78XX series of three terminal regulators is available with several fixed output voltages making them useful in a wide range of applications. One of these is local on card regulation, eliminating the distribution problems associated with single point regulation. The voltages available allow these regulators to be used in logic systems, instrumentation, HiFi, and other solid state electronic equipment. Although designed primarily as fixed voltage regulators these devices can be used with external components to obtain adjustable voltages and current.

Many of the fixed voltage regulator ICs has 3 leads and look like power transistors, such as the 7805 +5V 1A regulator shown on the right. They include a hole for attaching a [heat sink](#) if necessary.

1. Positive regulator

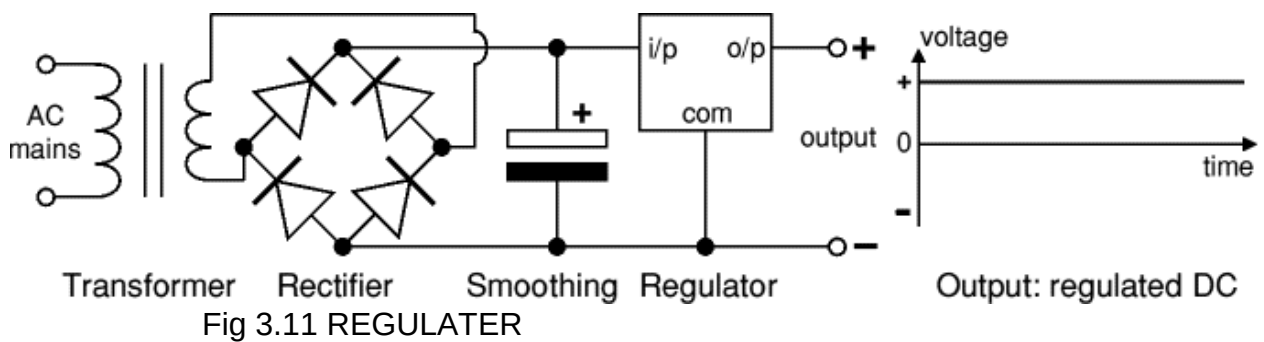
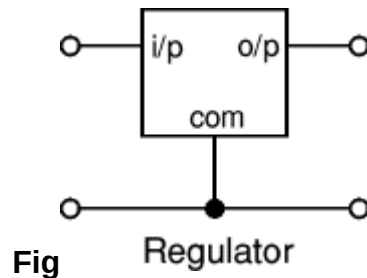
1. input pin
2. ground pin
3. output pin

It regulates the positive voltage

2. Negative regulator

1. ground pin
2. input pin
3. output pin

It regulate the negative voltage



The regulated DC output is very smooth with no ripple. It is suitable for all electronic circuits.

RFID reader:

An RFID reader is a device that is used to interrogate an RFID tag. The reader has an antenna that emits radio waves; the tag responds by sending back its data. A number of factors can affect the distance at which a tag can be read (the read range). The frequency used for identification, the antenna gain, the orientation and polarization of the reader antenna and the transponder antenna, as well as the placement of the tag on the object to be identified will all have an impact on the RFID system's read range.

Principle of Operation:

The reader generates a magnetic field through its integrated antenna at 125 kHz. Passive RFID transponders also have an integrated antenna that is tuned to the same frequency. When they are within range of the reader unit they are able to draw sufficient power from the electromagnetic field to power their own internal electronics.

Once powered they are able to modulate the incident magnetic field which is detected by the reader. In this way the Transponders are able to transmit their data to the reader.

There are many different types of transponders designed to operate at various frequencies, and their functions and the amount of information they carry can also vary. In general operation the reader will continually scan for any transponders that come within range and transmit their data to the reader. As EM4100 compatible transponders do not have collision avoidance algorithms only one card can be scanned within the range of the reader at any one time. When a transponder is read the reader will decode and transmit the received data via ASCII coded serial output, or standard Weigand output for the Weigand version of the reader unit.

Weigand Output Format description:

When using the Weigand output version the reader will scan for a valid transponder. When a read occurs the unit will transmit 40 bits of user data contained in the transponder in standard Weigand protocol.

The output lines for the Weigand output are the DATA0, and DATA1 lines as described in Table 1, 4 line interface. Weigand protocol provides 2 lines for data transfer. A pulsed transition on the DATA1 line indicates logic 1 bit, while a pulsed transition on the DATA0 line indicates a logic 0 bit. In their idle state both lines are held high. During data transfer the appropriate logic line will pulse low for 50uS followed by a period of 2ms where both lines are held high. In this fashion each bit is transmitted in sequence until all 40 bits are sent. The end of the transmission is signaled by both lines being held high for more than 50mS. Figure shows an example of the timing sequence for Weigand protocol.

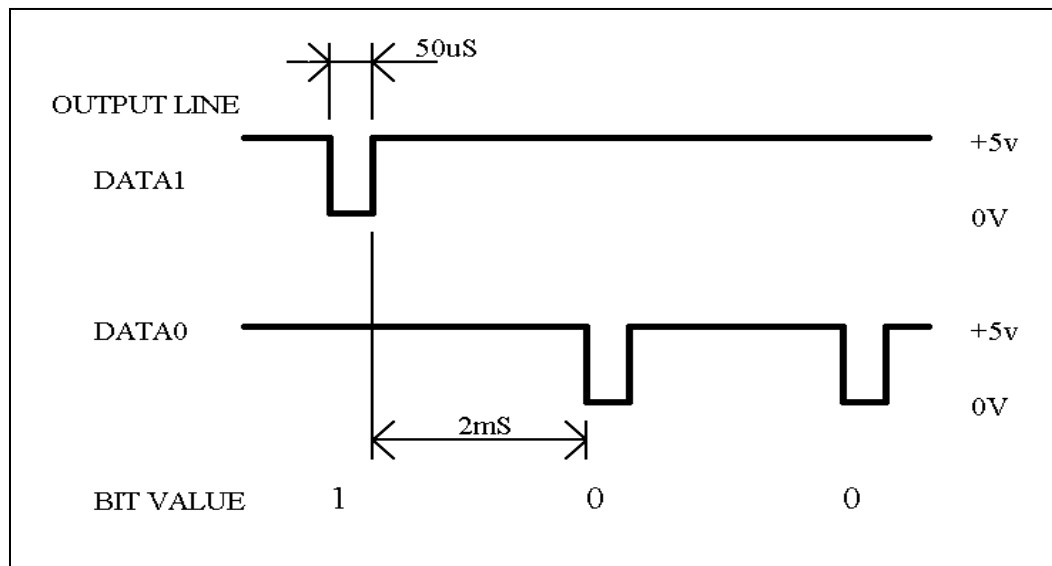


Fig 4.1 RFID READER

RFID TAG:

An RFID tag is a microchip combined with an antenna in a compact package; the packaging is structured to allow the RFID tag to be attached to an object to be tracked. "RFID" stands for Radio Frequency Identification. The tag's antenna picks up signals from an RFID reader or scanner and then returns the signal, usually with some additional data (like a unique serial number or other customized information).

RFID tags can be very small - the size of a large rice grain. Others may be the size of a small paperback book.

Active Tag (Active RFID Tag):

An RFID tag is an active tag when it is equipped with a battery that can be used as a partial or complete source of power for the tag's circuitry and antenna. Some active tags contain replaceable batteries for years of use; others are sealed units. (Note that It is also possible to connect the tag to an external power source.)

- Advantages of active RFID tags
- Problems and Disadvantages with active RFID tags
- Features of active RFID tags

The major advantages of an active rfid tag are:

- It can be read at distances of one hundred feet or more, greatly improving the utility of the device
- It may have other sensors that can use electricity for power.

The problems and disadvantages of an active RFID tag are:

- The tag cannot function without battery power, which limits the lifetime of the tag.
- The tag is typically more expensive, often costing \$20 or more each
- The tag is physically larger, which may limit applications.
- The long-term maintenance costs for an active RFID tag can be greater than those of a passive tag if the batteries are replaced.
- Battery outages in an active tag can result in expensive misreads.

Active RFID tags may have all or some of the following features:

- longest communication range of any tag
- the capability to perform independent monitoring and control
- the capability of initiating communications
- the capability of performing diagnostics
- the highest data bandwidth
- Active rfid tags may even be equipped with autonomous networking; the tags autonomously determine the best communication path.

Passive RFID Tag (or Passive Tag):

A passive tag is an RFID tag that does not contain a battery; the power is supplied by the reader. When radio waves from the reader are encountered by a passive rfid tag, the coiled antenna within the tag forms a magnetic field. The tag draws power from it, energizing the circuits in the tag. The tag then sends the information encoded in the tag's memory.

The major disadvantages of a passive rfid tag are:

- The tag can be read only at very short distances, typically a few feet at most. This greatly limits the device for certain applications.

- It may not be possible to include sensors that can use electricity for power.
- The tag remains readable for a very long time, even after the product to which the tag is attached has been sold and is no longer being tracked.

The advantages of a passive tag are:

- The tag functions without a battery; these tags have a useful life of twenty years or more.
- The tag is typically much less expensive to manufacture
- The tag is much smaller (some tags are the size of a grain of rice). These tags have almost unlimited applications in consumer goods and other areas.

(KEY) SWITCH:

A simple switch has an open state and closed state. However, a microcontroller needs to see a definite high or low voltage level at a digital input. A switch requires a pull-up or pull-down resistor to produce a definite high or low voltage when it is open or closed.

A resistor placed between a digital input and the supply voltage is called a "pull-up" resistor because it normally pulls the pin's voltage up to the supply. A switch placed between the digital input and ground will short the digital input to ground when it is pressed. This means the voltage seen at the input will be high when the switch is open and low when the switch is closed.

A resistor placed between a digital input and ground is called a "pull-down" resistor because it normally pulls the pin's voltage down to ground. A switch placed between the digital input and the voltage supply will short the digital input to the voltage supply when it is pressed. This means the voltage seen at the input will be low when the switch is open and high when the switch is closed.

A pull-up or pull-down resistor can be quite large and still work properly. Values from 1K to 10K are typical. Some typical switch circuits are shown below.

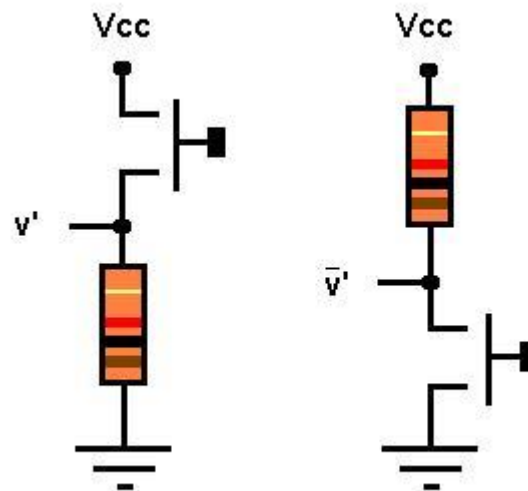


Fig 4.2 Sample push-button circuits.

A push button switch is used to either close or open an electrical circuit depending on the application. Push button switches are used in various applications such as industrial equipment control handles, outdoor controls, mobile communication terminals, and medical equipment, and etc.

Push Button Switch (Normally Open)

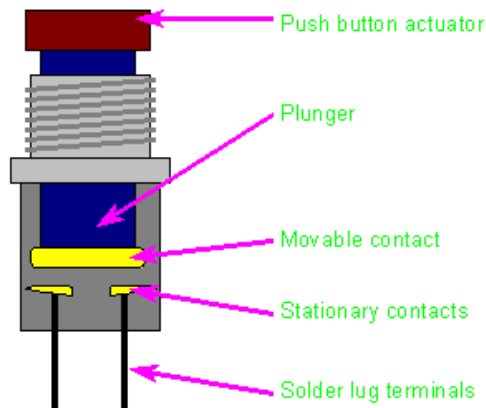


Fig 4.3 push button switch

ACCELEROMETER:

An **accelerometer** is a device that measures [proper acceleration](#); proper acceleration is not the same as coordinate acceleration (rate of change of velocity). For example, an accelerometer at rest on the surface of the Earth will measure an

acceleration due to Earth's gravity, straight upwards (by definition) of $g \approx 9.81 \text{ m/s}^2$. By contrast, accelerometers in [free fall](#) (falling toward the center of the Earth at a rate of about 9.81 m/s^2) will measure zero.

Accelerometers have multiple applications in industry and science. Highly sensitive accelerometers are components of [inertial navigation systems](#) for aircraft and missiles. Accelerometers are used to detect and monitor vibration in rotating machinery. Accelerometers are used in [tablet computers](#) and digital cameras so that images on screens are always displayed upright. Accelerometers are used in drones for flight stabilisation. Coordinated accelerometers can be used to measure differences in proper acceleration, particularly gravity, over their separation in space; i.e., gradient of the [gravitational field](#). This [gravity gradiometry](#) is useful because absolute gravity is a weak effect and depends on local density of the Earth which is quite variable.

Single- and multi-axis models of accelerometer are available to detect magnitude and direction of the proper acceleration, as a [vector](#) quantity, and can be used to sense orientation (because direction of weight changes), coordinate acceleration, vibration, [shock](#), and falling in a resistive medium (a case where the proper acceleration changes, since it starts at zero, then increases). [Micromachined](#) accelerometers are increasingly present in portable electronic devices and video game controllers, to detect the position of the device or provide for game input.

An accelerometer measures [proper acceleration](#), which is the acceleration it experiences relative to free fall and is the acceleration felt by people and objects. Put another way, at any point in spacetime the [equivalence principle](#) guarantees the existence of a local [inertial frame](#), and an accelerometer measures the acceleration relative to that frame.^[1] Such accelerations are popularly denoted [g-force](#); i.e., in comparison to [standard gravity](#).

Accelerometers are devices that measure acceleration, which is the rate of change of the velocity of an object. They measure in meters per second squared (m/s^2) or in G-forces (g). A single G-force for us here on planet Earth is equivalent to 9.8 m/s^2 , but this does vary slightly with elevation (and will be a different value on different planets

due to variations in gravitational pull). Accelerometers are useful for sensing vibrations in systems or for orientation applications.

Types of Accelerometer:

There are several different principles upon which an analog accelerometer can be built. Two very common types utilize capacitive sensing and the piezoelectric effect to sense the displacement of the proof mass proportional to the applied acceleration.

Capacitive:

Accelerometers that implement capacitive sensing output a voltage dependent on the distance between two planar surfaces. One or both of these “plates” are charged with an electrical current. Changing the gap between the plates changes the electrical capacity of the system, which can be measured as a voltage output. This method of sensing is known for its high accuracy and stability. Capacitive accelerometers are also less prone to noise and variation with temperature, typically dissipate less power, and can have larger bandwidths due to internal feedback circuitry. (Elwenspoek 1993)

Piezoelectric:

Piezoelectric sensing of acceleration is natural, as acceleration is directly proportional to force. When certain types of crystal are compressed, charges of opposite polarity accumulate on opposite sides of the crystal. This is known as the piezoelectric effect. In a piezoelectric accelerometer, charge accumulates on the crystal and is translated and amplified into either an output current or voltage.

Piezoelectric accelerometers only respond to AC phenomenon such as vibration or shock. They have a wide dynamic range, but can be expensive depending on their quality (Doscher 2005)

Piezo-film based accelerometers are best used to measure AC phenomenon such as vibration or shock, rather than DC phenomenon such as the acceleration of gravity. They are inexpensive, and respond to other phenomenon such as temperature, sound, and pressure (Doscher 2005)

Overview of other types that are less used in audio applications

Piezoresistive:

Piezoresistive accelerometers (also known as Strain gauge accelerometers) work by measuring the electrical resistance of a material when mechanical stress is applied. They are preferred in high shock applications and they can measure acceleration down to 0Hz. However, they have a limited high frequency response.

Hall effect:

Hall effect accelerometers work by measuring the voltage variations caused by the change in magnetic field around them.

Heat transfer:

Heat transfer accelerometers consist in a single heat source centered in a substrate and suspended across cavity. They include equally spaced thermoresistors on the four side of the heat source. They measure the internal changes in heat due to an acceleration. When there is zero acceleration, the heat gradient will be symmetrical. Otherwise, under acceleration, the heat gradient will become asymmetrical due to convection heat transfer

Other:

There are many other types of accelerometer, including:

- Null-balance
- Servo force balance
- Strain gauge
- Resonance
- Optical
- Surface acoustic wave (SAW)

Specifications:

A typical accelerometer has the following basic specifications:

- Analog/digital
- Number of axes
- Output range (maximum swing)
- Sensitivity (voltage output per g)

- Dynamic range
- Bandwidth
- Amplitude stability
- Mass

Analog vs. Digital: The most important specification of an accelerometer for a given application is its type of output. Analog accelerometers output a constant variable voltage depending on the amount of acceleration applied. Older digital accelerometers output a variable frequency square wave, a method known as pulse-width modulation. A pulse width modulated accelerometer takes readings at a fixed rate, typically 1000 Hz (though this may be user-configurable based on the IC selected). The value of the acceleration is proportional to the pulse width (or duty cycle) of the PWM signal. Newer digital accelerometers are more likely to output their value using multi-wire digital protocols such as I²C or SPI.

For use with adcs commonly used for music interaction systems, analog accelerometers are usually preferred.

Number of axes: Accelerometers are available that measure in one, two, or three dimensions. The most familiar type of accelerometer measures across two axes. However, three-axis accelerometers are increasingly common and inexpensive.

Output range: To measure the acceleration of gravity for use as a tilt sensor, an output range of ± 1.5 g is sufficient. For use as an impact sensor, one of the most common musical applications, ± 5 g or more is desired.

Sensitivity: An indicator of the amount of change in output signal for a given change in acceleration. A sensitive accelerometer will be more precise and probably more accurate.

Dynamic range: The range between the smallest acceleration detectable by the accelerometer to the largest before distorting or clipping the output signal.

Bandwidth: The bandwidth of a sensor is usually measured in Hertz and indicates the limit of the near-unity frequency response of the sensor, or how often a reliable reading can be taken. Humans cannot create body motion much beyond the range of 10-12 Hz. For this reason, a bandwidth of 40-60 Hz is adequate for tilt or human motion sensing. For vibration measurement or accurate reading of impact forces, bandwidth should be in the range of hundreds of Hertz. It should also be noted that for some older microcontrollers, the bandwidth of an accelerometer may extend

beyond the Nyquist frequency of the A/D converters on the MCU, so for higher bandwidth sensing, the digital signal may be aliased. This can be remedied with simple passive low-pass filtering prior to sampling, or by simply choosing a better microcontroller. It is worth noting that the bandwidth may change by the way the accelerometer is mounted. A stiffer mounting (ex: using studs) will help to keep a higher usable frequency range and the opposite (ex: using a magnet) will reduce it.

Amplitude stability: This is not a specification in itself, but a description of several. Amplitude stability describes a sensor's change in sensitivity depending on its application, for instance over varying temperature or time (see below).

Mass: The mass of the accelerometer should be significantly smaller than the mass of the system to be monitored so that it does not change the characteristic of the object being tested.

Other specifications include:

- Zero g offset (voltage output at 0 g)
- Noise (sensor minimum resolution)
- Temperature range
- Bias drift with temperature (effect of temperature on voltage output at 0 g)
- Sensitivity drift with temperature (effect of temperature on voltage output per g)
- Power consumption

Output:

An accelerometer output value is a scalar corresponding to the magnitude of the acceleration vector. The most common acceleration, and one that we are constantly exposed to, is the acceleration that is a result of the earth's gravitational pull. This is a common reference value from which all other accelerations are measured (known as g, which is $\sim 9.8\text{m/s}^2$).

Digital output:

Accelerometers with PWM output can be used in two different ways. For most accurate results, the PWM signal can be input directly to a microcontroller where the duty cycle is read in firmware and translated into a scaled acceleration value. (Check with the datasheet to obtain the scaling factor and required output impedance.) When a microcontroller with PWM input is not available, or when other means of digitizing the signal are being used, a simple RC reconstruction filter can be used to obtain an

analog voltage proportional to the acceleration. At rest (50% duty-cycle) the output voltage will represent no acceleration, higher voltage values (resulting from a higher duty cycle) will represent positive acceleration, and lower values (<50% duty cycle) indicate negative acceleration. These voltages can then be scaled and used as one might the output voltage of an analog output accelerometer. One disadvantage of a digital output is that it takes a little more timing resources of the microcontroller to measure the duty cycle of the PWM signal. Communication protocols could use I2C or SPI.

Analog output

When compared to most other industrial sensors, analog accelerometers require little conditioning and the communication is simple by only using an Analog to Digital Converter (ADC) on the microcontroller. Typically, an accelerometer output signal will need an offset, amplification, and filtration. For analog voltage output accelerometers, the signal can be a positive or negative voltage, depending on the direction of the acceleration. Also, the signal is continuous and proportional to the acceleration force. As with any sensor destined for an analog to digital converter, the value must be scaled and/or amplified to maximally span the range of acquisition. Most analog to digital converters used in musical applications acquire signals in the 0-5 V range.

The image at right depicts an amplification and offset circuit, including the on-board operational amplifier in the adxl 105, minimizing the need for additional IC components. The gain applied to the output is set by the ratio $R2/R1$. The offset is controlled by biasing the voltage with variable resistor $R4$. Accelerometers output bias will drift according to ambient temperature. The sensors are calibrated for operation at a specific temperature, typically room temperature. However, in most short duration indoor applications the offset is relatively constant and stable, and thus does not need adjustment. If the sensor is intended to be used in multiple environments with differing ambient temperatures, the bias function should be sufficient for analog calibration of the device. If the ambient temperature is subject to drastic changes over the course of a single usage, the temperature output should be summed into the bias circuit. Smart sensors may even take this into consideration.

The resolution of the data acquired is ultimately determined by the analog to digital converter. It is possible, however, that the noise floor is above the minimum resolution of the converter, reducing the resolution of your system. Assuming that the noise is equally distributed across all frequencies, it is possible to filter the signal to only include frequencies within the range of operation. The filter required depends upon both the type of acquisition as well as the location of the sensor. The bandwidth is primarily influenced by the three different modes of operation of the sensor.

Uses:

The acceleration measurement has a variety of uses. The sensor can be implemented in a system that detects velocity, position, shock, vibration, or the acceleration of gravity to determine orientation (Doscher 2005)

A system consisting of two orthogonal sensors is capable of sensing pitch and roll. This is useful in capturing head movements. A third orthogonal sensor can be added to the network to obtain orientation in three dimensional space. This is appropriate for the detection of pen angles, etc. The sensing capabilities of this network can be furthered to six degrees of spatial measurement freedom by the addition of three orthogonal gyroscopes.

As a shock detector, an accelerometer is looking for changes in acceleration. This jerk is sensed as an overdamped vibration.

Verplaetse has outlined the bandwidths associated with various implementations of accelerometers as an input device. These are:

Location	Usage	Frequency	Acceleration
Head	Tilt	0-8 Hz	Xx
Hand , Wrist, Finger	Cont.	8-12 Hz	0.04-1.0 g
Hand, Arm, Upper Body	Cont.	0-12 Hz	0.5-9.0 g
Foot, Leg	Cont.	0-12 Hz	0.2-6.6 g

How an Accelerometer Works

Accelerometers are electromechanical devices that sense either static or dynamic forces of acceleration. Static forces include gravity, while dynamic forces can include vibrations and movement.

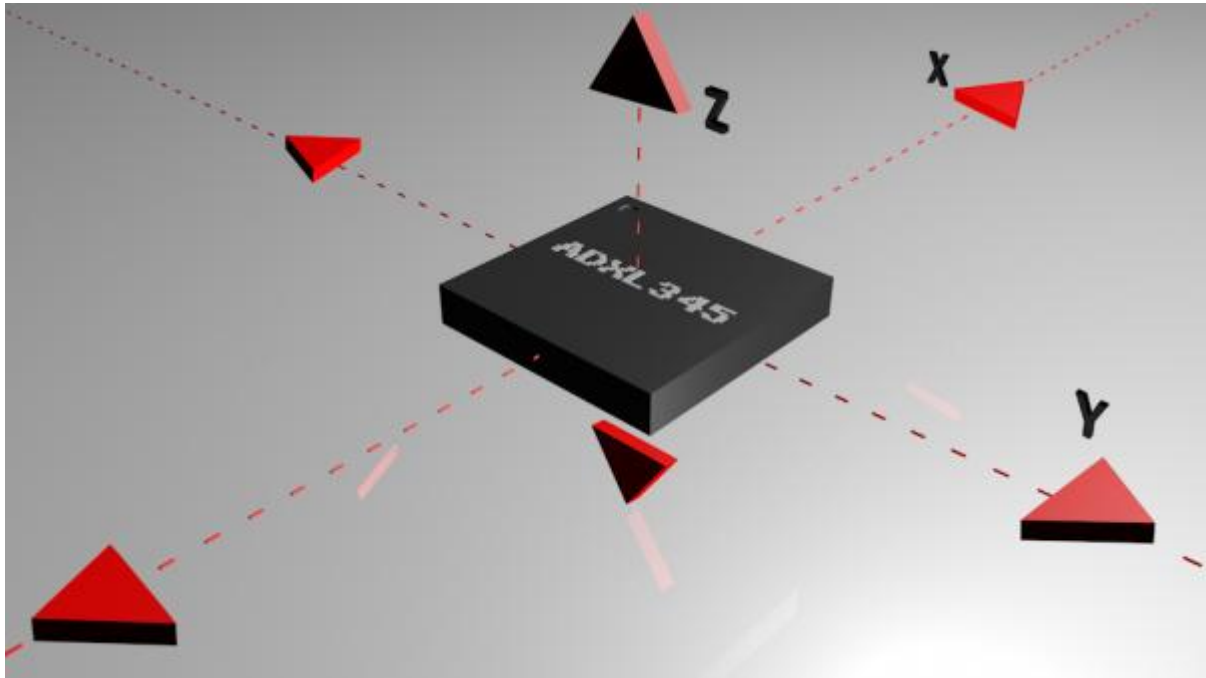


Fig 5.1 Axes of measurement for a triple axis accelerometer

Accelerometers can measure acceleration on one, two, or three axes. 3-axis units are becoming more common as the cost of development for them decreases.

Generally, accelerometers contain capacitive plates internally. Some of these are fixed, while others are attached to miniscule springs that move internally as acceleration forces act upon the sensor. As these plates move in relation to each other, the capacitance between them changes. From these changes in capacitance, the acceleration can be determined.

Other accelerometers can be centered around piezoelectric materials. These tiny crystal structures output electrical charge when placed under mechanical stress (e.g. Acceleration).

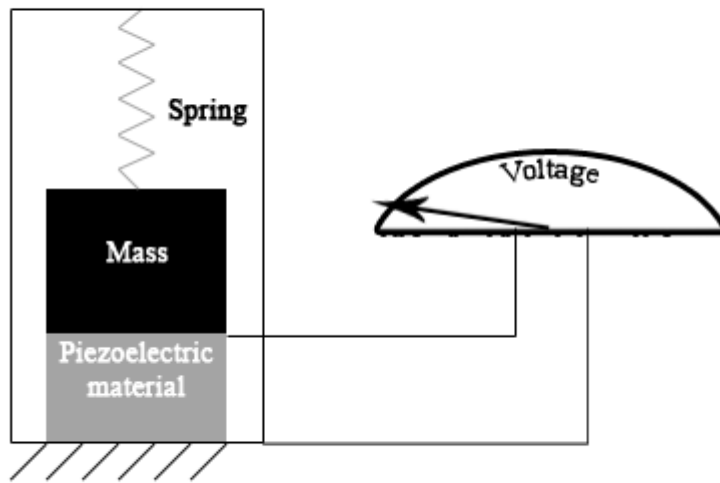


Fig 5.2 An example of the inside of a piezoelectric accelerometer

How to Connect to an Accelerometer:

For most accelerometers, the basic connections required for operation are power and the communication lines. As always, read the datasheet to ensure proper connections are made.

Communication Interface

Accelerometers will communicate over an analog, digital, or pulse-width modulated connection interface.

- Accelerometers with an analog interface show accelerations through varying voltage levels. These values generally fluctuate between ground and the supply voltage level. An ADC on a microcontroller can then be used to read this value. These are generally less expensive than digital accelerometers.
- Accelerometers with a digital interface can either communicate over SPI or I²C communication protocols. These tend to have more functionality and be less susceptible to noise than analog accelerometers.

- Accelerometers that output data over pulse-width modulation (PWM) output square waves with a known period, but a duty cycle that varies with changes in acceleration.

Power:

Accelerometers are generally low-power devices. The required current typically falls in the micro (μ) or milli-amp range, with a supply voltage of 5V or less. The current consumption can vary depending on the settings (e.g., power saving mode versus standard operating mode). These different modes can make accelerometers well suited for battery powered applications.

Make sure that proper logic levels are matched, especially with the digital interfaces.

How to Select an Accelerometer:

When choosing which accelerometer to use, several features are important to consider including power requirements and communication interfaces as discussed previously. Additional features for consideration are below.

Range:

Most accelerometers will have a selectable range of forces they can measure. These ranges can vary from $\pm 1g$ up to $\pm 250g$. Typically, the smaller the range, the more sensitive the readings will be from the accelerometer. For example, to measure small vibrations on a tabletop, using a small-range accelerometer will provide more detailed data than using a 250g range (which is more suited for rockets).

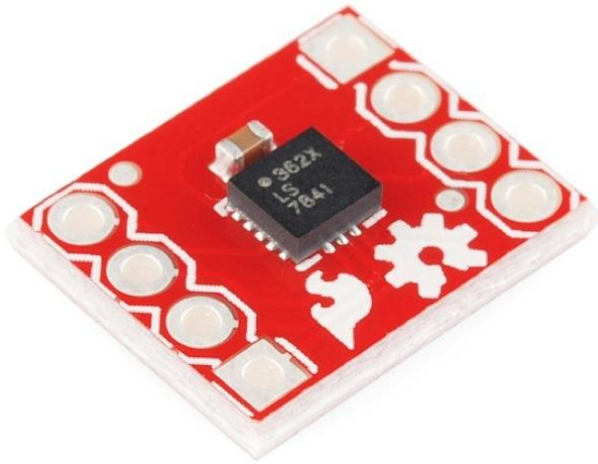


Fig 5.3 The ADXL362 Triple Axis Accelerometer can measure $\pm 2g$, $\pm 4g$, and $\pm 8g$.

TYPES OF ACCELEROMETER

- Bulk micromachined capacitive
- Bulk micromachined piezoelectric resistive
- Capacitive spring mass system base
- DC response
- Electromechanical servo (Servo Force Balance)
- High gravity
- High temperature
- Laser accelerometer
- Low frequency
- Magnetic induction
- Modally tuned impact hammers
- Null-balance
- Optical
- Pendulous integrating gyroscopic accelerometer (PIGA)
- Piezoelectric accelerometer
- Quantum (Rubidium atom cloud, laser cooled)
- Resonance
- Seat pad accelerometers
- Shear mode accelerometer

- Strain gauge
- Surface acoustic wave (SAW)
- Surface micromachined capacitive (MEMS)
- Thermal (submicrometre CMOS process)
- Triaxial
- Vacuum diode with flexible anode^[31]
- Potentiometric type
- LVDT type accelerometer

Additional Features:

Some accelerometers include features such as tap detection (useful for low-power applications), free-fall detection (used for Active Hard Drive Protection), temperature compensation (to increase accuracy in dead reckoning situations) and 0-g range sensing, which are other features to take into consideration when purchasing an accelerometer. The need for these types of features on the accelerometer will be determined by the application in which the accelerometer is incorporated.

There are also imus (Inertial Measurement Units) available, which can include accelerometers, gyroscopes and even, occasionally, magnetometers into a single IC package or board. Some examples of this include the MPU6050 and MPU9150. These are commonly used in motion tracking applications and UAV guidance systems, where location and orientation of an object is important.

The reason for the appearance of a gravitational offset is Einstein's [equivalence principle](#), which states that the effects of gravity on an object are indistinguishable from acceleration. When held fixed in a gravitational field by, for example, applying a ground reaction force or an equivalent upward thrust, the reference frame for an accelerometer (its own casing) accelerates upwards with respect to a free-falling reference frame. The effects of this acceleration are indistinguishable from any other acceleration experienced by the instrument, so that an accelerometer cannot detect the difference between sitting in a rocket on the launch pad, and being in the same rocket in deep space while it uses its engines to accelerate at 1 g. For similar reasons, an accelerometer will read zero during any type of [free fall](#). This includes use in a coasting spaceship in deep space far from any

mass, a spaceship orbiting the Earth, an airplane in a parabolic "zero-g" arc, or any free-fall in vacuum. Another example is free-fall at a sufficiently high altitude that atmospheric effects can be neglected.

Modern accelerometers are often small *micro electro-mechanical systems* ([MEMS](#)), and are indeed the simplest MEMS devices possible, consisting of little more than a [cantilever beam](#) with a [proof mass](#) (also known as *seismic mass*). Damping results from the residual gas sealed in the device. As long as the [Q-factor](#) is not too low, damping does not result in a lower sensitivity.

Under the influence of external accelerations the proof mass deflects from its neutral position. This deflection is measured in an analog or digital manner. Most commonly, the capacitance between a set of fixed beams and a set of beams attached to the proof mass is measured. This method is simple, reliable, and inexpensive. Integrating [piezoresistors](#) in the springs to detect spring deformation, and thus deflection, is a good alternative, although a few more process steps are needed during the fabrication sequence. For very high sensitivities [quantum tunneling](#) is also used; this requires a dedicated process making it very expensive. Optical measurement has been demonstrated on laboratory scale.

Another, far less common, type of MEMS-based accelerometer contains a small heater at the bottom of a very small dome, which heats the air inside the dome to cause it to rise. A thermocouple on the dome determines where the heated air reaches the dome and the deflection off the center is a measure of the acceleration applied to the sensor.

Most micromechanical accelerometers operate *in-plane*, that is, they are designed to be sensitive only to a direction in the plane of the [die](#). By integrating two devices perpendicularly on a single die a two-axis accelerometer can be made. By adding another *out-of-plane* device three axes can be measured. Such a combination may have much lower misalignment error than three discrete models combined after packaging.

Micromechanical accelerometers are available in a wide variety of measuring ranges, reaching up to thousands of *g*'s. The designer must make a compromise between sensitivity and the maximum acceleration that can be measured.

APPLICATIONS

Engineering:

Accelerometers can be used to measure vehicle acceleration. Accelerometers can be used to measure vibration on cars, machines, buildings, process control systems and safety installations. They can also be used to measure seismic activity, inclination, machine vibration, dynamic distance and speed with or without the influence of gravity. Applications for accelerometers that measure gravity, wherein an accelerometer is specifically configured for use in gravimetry, are called gravimeters.

Notebook computers equipped with accelerometers can contribute to the *Quake-Catcher Network* (QCN), a BOINC project aimed at scientific research of earthquakes.

Biology:

Accelerometers are also increasingly used in the biological sciences. High frequency recordings of bi-axis or tri-axial acceleration^[6] allows the discrimination of behavioral patterns while animals are out of sight. Furthermore, recordings of acceleration allow researchers to quantify the rate at which an animal is expending energy in the wild, by either determination of limb-stroke frequency^[7] or measures such as overall dynamic body acceleration^[8] Such approaches have mostly been adopted by marine scientists due to an inability to study animals in the wild using visual observations, however an increasing number of terrestrial biologists are adopting similar approaches. This device can be connected to an amplifier to amplify the signal.

Industry:

Accelerometers are also used for machinery health monitoring to report the vibration and its changes in time of shafts at the bearings of rotating equipment such as turbines, pumps fans, rollers, compressors, or bearing faults which, if not attended to promptly, can lead to costly repairs. Accelerometer vibration data allows the user to monitor machines and detect these faults before the rotating equipment fails completely.

Building and structural monitoring

Accelerometers are used to measure the motion and vibration of a structure that is exposed to dynamic loads. Dynamic loads originate from a variety of sources including:

- Human activities – walking, running, dancing or skipping
- Working machines – inside a building or in the surrounding area
- Construction work – driving piles, demolition, drilling and excavating
- Moving loads on bridges
- Vehicle collisions
- Impact loads – falling debris
- Concussion loads – internal and external explosions
- Collapse of structural elements
- Wind loads and wind gusts
- Air blast pressure
- Loss of support because of ground failure
- Earthquakes and aftershocks

Under structural applications, measuring and recording how a structure dynamically responds to these inputs is critical for assessing the safety and viability of a structure. This type of monitoring is called Health Monitoring, which usually involves other types of instruments, such as displacement sensors -Potentiometers, Ivdts, etc.- deformation sensors -Strain Gauges, Extensometers-, load sensors -Load Cells, Piezo-Electric Sensors- among others.

Medical applications:

Zoll's AED Plus uses CPR-D•padz which contain an accelerometer to measure the depth of CPR chest compressions.

Within the last several years, several companies have produced and marketed sports watches for runners that include footpods, containing accelerometers to help determine the speed and distance for the runner wearing the unit.

In Belgium, accelerometer-based step counters are promoted by the government to encourage people to walk a few thousand steps each day.

Herman Digital Trainer uses accelerometers to measure strike force in physical training.^{[16][17]}

It has been suggested to build football helmets with accelerometers in order to measure the impact of head collisions.^[18]

Accelerometers have been used to calculate gait parameters, such as stance and swing phase. This kind of sensor can be used to measure or monitor people.^{[19][20]}

Navigation

Main article: Inertial navigation system

An inertial navigation system is a navigation aid that uses a computer and motion sensors (accelerometers) to continuously calculate via dead reckoning the position, orientation, and velocity (direction and speed of movement) of a moving object without the need for external references. Other terms used to refer to inertial navigation systems or closely related devices include inertial guidance system, inertial reference platform, and many other variations.

An accelerometer alone is unsuitable to determine changes in altitude over distances where the vertical decrease of gravity is significant, such as for aircraft and rockets. In the presence of a gravitational gradient, the calibration and data reduction process is numerically unstable.^{[21][22]}

Transport:

Accelerometers are used to detect apogee in both professional^[23] and in amateur^[24] rocketry.

Accelerometers are also being used in Intelligent Compaction rollers. Accelerometers are used alongside gyroscopes in inertial navigation systems.^[25]

One of the most common uses for MEMS accelerometers is in airbag deployment systems for modern automobiles. In this case the accelerometers are used to detect the rapid negative acceleration of the vehicle to determine when a collision has occurred and the severity of the collision. Another common automotive use is in electronic stability control systems, which use a lateral accelerometer to measure cornering forces. The widespread use of accelerometers in the automotive industry has pushed their cost down dramatically.^[26] Another automotive application is the

monitoring of noise, vibration, and harshness (NVH), conditions that cause discomfort for drivers and passengers and may also be indicators of mechanical faults.

Tilting trains use accelerometers and gyroscopes to calculate the required tilt.^[27]

Volcanology:

Modern electronic accelerometers are used in remote sensing devices intended for the monitoring of active volcanoes to detect the motion of magma^[28]

Consumer electronics:

Accelerometers are increasingly being incorporated into personal electronic devices to detect the orientation of the device, for example, a display screen.

A *free-fall sensor* (FFS) is an accelerometer used to detect if a system has been dropped and is falling. It can then apply safety measures such as parking the head of a hard disk to prevent a head crash and resulting data loss upon impact. This device is included in the many common computer and consumer electronic products that are produced by a variety of manufacturers. It is also used in some data loggers to monitor handling operations for shipping containers. The length of time in free fall is used to calculate the height of drop and to estimate the shock to the package.

Orientation sensing:

A number of 21st century devices use accelerometers to align the screen depending on the direction the device is held, for example switching between portrait and landscape modes. Such devices include many tablet pcs and some smartphones and digital cameras. The Amida Simputer, a handheld Linux device launched in 2004, was the first commercial handheld to have a built-in accelerometer. It had incorporated many gesture based interactions using this accelerometer, including page-turning, zoom-in and zoom-out of images, change of portrait to landscape mode and many simple gesture-based games.

As of January 2009, almost all new mobile phones and digital cameras contain at least a tilt sensor and sometimes an accelerometer for the purpose of auto image rotation, motion-sensitive mini-games, and to correct shake when taking photographs.

Image stabilization:

Camcorders use accelerometers for image stabilization, either by moving optical elements to adjust the light path to the sensor to cancel out unintended motions or digitally shifting the image to smooth out detected motion. Some stills cameras use accelerometers for anti-blur capturing. The camera holds off capturing the image when the camera is moving. When the camera is still (if only for a millisecond, as could be the case for vibration), the image is captured. An example of the application of this technology is the Glogger VS2,^[30] a phone application which runs on Symbian based phones with accelerometers such as the Nokia N96. Some digital cameras contain accelerometers to determine the orientation of the photo being taken and also for rotating the current picture when viewing.

Device integrity:

Many laptops feature an accelerometer which is used to detect drops. If a drop is detected, the heads of the hard disk are parked to avoid data loss and possible head or disk damage by the ensuing shock.

Gravimetry:

A **gravimeter** or gravitometer, is an instrument used in gravimetry for measuring the local gravitational field. A gravimeter is a type of accelerometer, except that accelerometers are susceptible to all vibrations including noise, that cause oscillatory accelerations. This is counteracted in the gravimeter by integral vibration isolation and signal processing. Though the essential principle of design is the same as in accelerometers, gravimeters are typically designed to be much more sensitive than accelerometers in order to measure very tiny changes within the Earth's gravity, of 1 *g*. In contrast, other accelerometers are often designed to measure 1000 *g* or more, and many perform multi-axial measurements. The constraints on temporal resolution are usually less for gravimeters, so that resolution can be increased by processing the output with a longer "time constant".

PIC MICROCONTROLLER:

PIC is a family of Harvard architecture microcontrollers made by Microchip Technology, derived from the PIC1640. Originally developed by General Instrument's

Microelectronics Division. The name PIC initially referred to "**Programmable Interface Controller**".

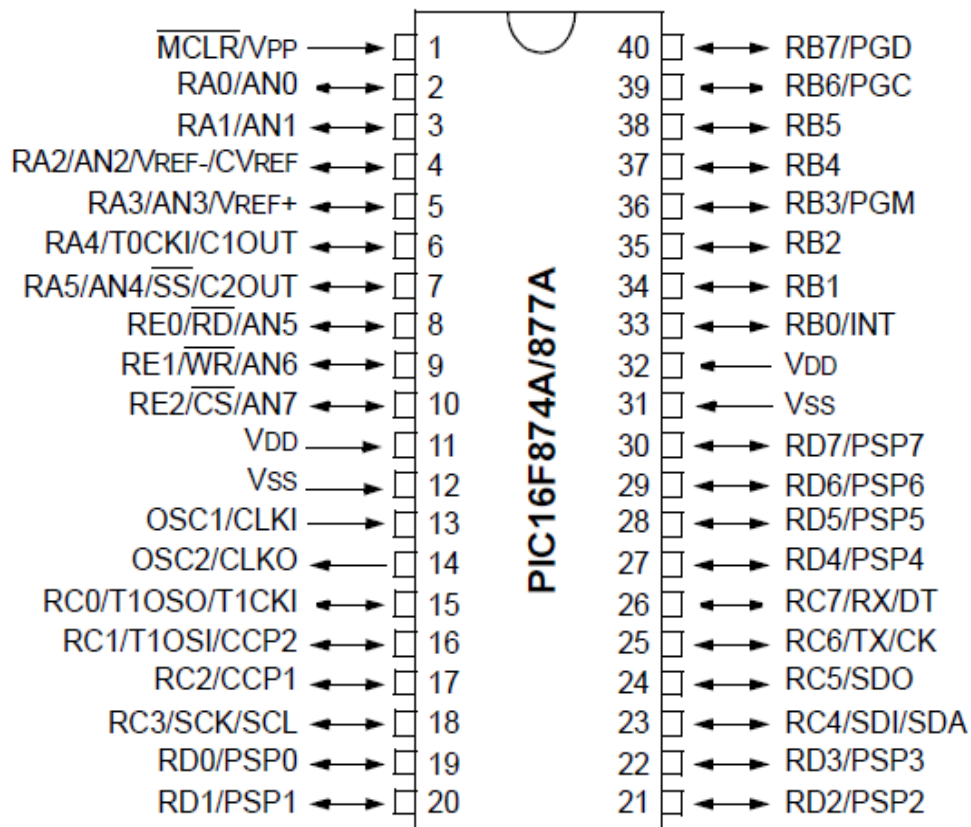


Fig 5.4 Pin diagram of PIC 16F877

PIN 1: MCLR

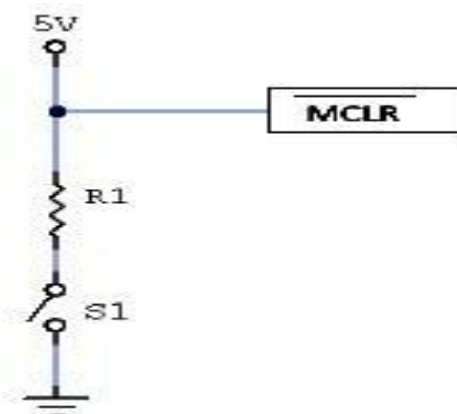


Fig 5.5 PIN 1

PIN 2: RA0/AN0

PIN 3: RA1/AN1

PIN 4: RA2/AN2/Vref-

PIN 5: RA3/AN3/Vref+

PIN 6: RA0/T0CKI:

PIN 7: RA5/SS/AN4:

PIN 8: RE0/RD/AN5:

PIN 9: RE1/WR/AN6:

PIN 10: RE2/CS/A7:

PIN 11 and 32: VDD:

PIN 12 and 31: VSS:

PIN 13: OSC1/CLKIN:

PIN 14: OSC2/CLKOUT:

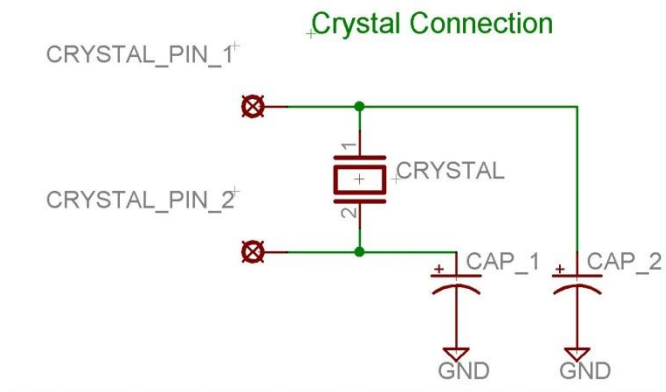


Fig 5.6 PIN 14

PIN 15: RC0/T1OCO/T1CKI:

PIN 16: RC1/T1OSI/CCP2:

PIN 17: RC2/CCP1:

PIN 18: RC3/SCK/SCL

PIN 23: RC4/SDI/SDA

PIN 24: RC5/SDO

PIN 25: RC6/TX/CK

PIN 26: RC7/RX/DT

PIN 19,20,21,22,27,28,29,30:

PIN 33-40: PORT B

BUZZER

A buzzer or beeper is a signaling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows.

It most commonly consists of a number of switches or sensors connected to a control

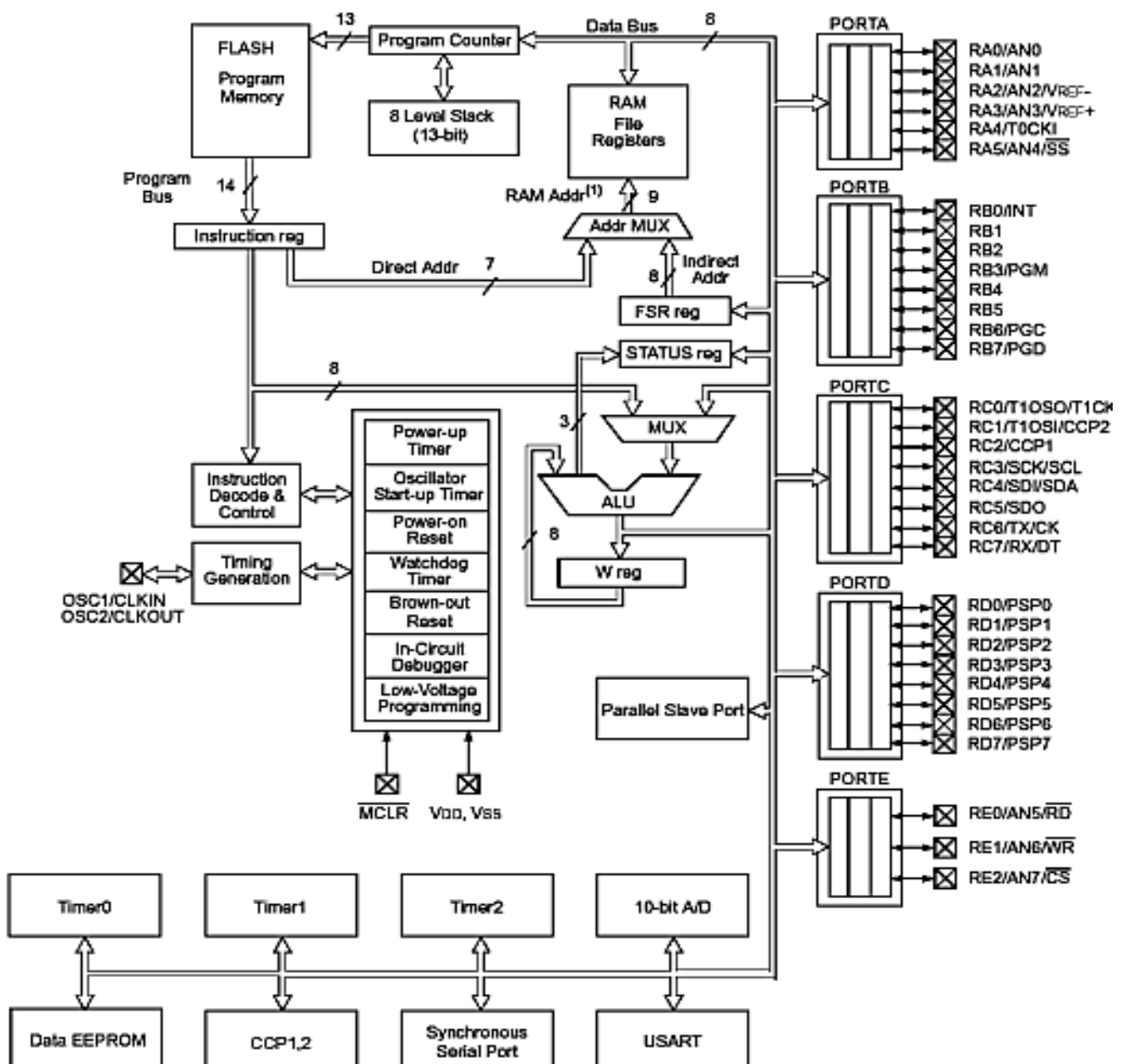


Fig 5.7 BUZZER

unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise). Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker. Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a Sonalert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

In game shows it is also known as a "lockout system," because when one person signals ("buzzes in"), all others are locked out from signalling. Several game shows have large buzzer buttons which are identified as "plungers".

The word "buzzer" comes from the rasping noise that buzzers made when they were electromechanical devices, operated from stepped-down AC line voltage at 50 or 60 cycles. Other sounds commonly used to indicate that a button has been pressed are a ring or a beep.

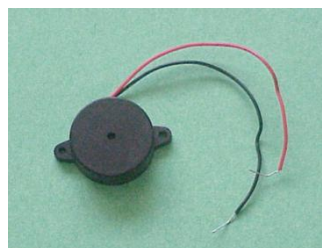


Fig 5.7 Buzzer

LCD DISPLAY

Liquid crystal cell displays (LCDs) are used in similar applications where LEDs are used. These applications are display of numeric and alphanumeric characters in dot matrix and segmental displays.

LCDs are of two types:

- I. Dynamic scattering type
- II. Field effect type



Fig 6.1 LCD DISPLAY

PIN DESCRIPTION FOR LCD:

PIN NO	SYMBOL	FUNCTION
1	Vss	Ground terminal of Module
2	Vdd	Supply terminal of Module, +5v
3	Vo	Power supply for liquid crystal drive
4	RS	Register select RS=0...Instruction register RS=1...Data register

5	R/W	Read/Write R/W=1...Read R/W=0...Write
6	EN	Enable
7-14	DB0-DB7	Bi-directional Data Bus. Data Transfer is performed once ,thru DB0-DB7,in case of interface data length is 8-bits;and twice, thru DB4-DB7 in the case of interface data length is 4-bits.Upper four bits first then lower four bits.
15	LAMP-(L-)	LED or EL lamp power supply terminals
16	LAMP+(L+) (E2)	Enable

LCD PIN DESCRIPTIONS:

The function of each pins of LCD is described below **VCC**, **VSS** and **VEE** while v and v provide +5v and ground, respectively, v is used for controlling LCD contrast.

RS, register select:

There are two very important registers inside the LCD. The RS pin is used for their selection as follows. If RS=0, the instruction code register is selected, allowing the user to send a command such as clear display, cursor at home,etc.if RS=1 the data register is selected, allowing the user to send data to be displayed on the LCD.

R/W, read/write:

R/W input allows the user to write information to the LCD or read information from it. R/W=1 when reading; R/W=0 when writing.

E, enable

The enable pin is used by the LCD to latch information presented on its data pins. When data is supplied to data pins, a high to low pulse must be applied to this pin in order for the LCD to latch in the data present at the data pins.

D0 - D7

The 8-bit data pins, D0 – D7, are used to send information to the LCD or read contents of the LCD'S internal registers. There are also instruction codes that can be sent to the LCD to clear the display or force the cursor to the home position or blink the cursor. RS=0 is used to check the busy flag bit to see if the LCD is ready to receive information. The busy flag is D7 and can be read when R/W=1 and RS=0, as follows: if R/W=1, RS=0, when D7=1, the LCD is busy taking care of internal operation and will not accept any new information, when D7=0, the LCD is ready to receive new information.

LCD INTERFACING WITH MICROCONTROLLER:

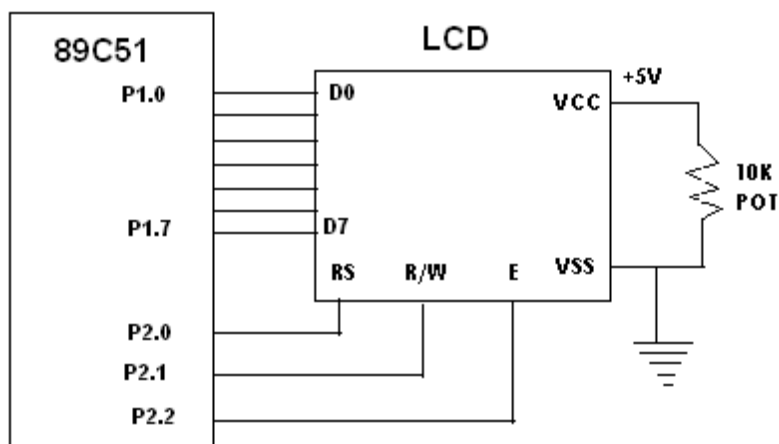
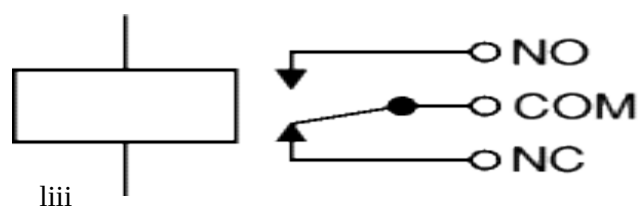


Fig 6.2 LCD INTERFACING AND MICROCONTROLLER

RELAYS:

Fig 6.3 Relays



A relay is an **electrically operated switch**. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have **double throw (changeover)** switch contacts as shown in the diagram.



Fig 6.4 Relays

Relays allow one circuit to switch a second circuit which can be completely separate from the first. For example a low voltage battery circuit can use a relay to switch a 230V AC mains circuit.

There is no electrical connection inside the relay between the two circuits, the link is magnetic and mechanical.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.

Relays are usually SPDT or DPDT but they can have many more sets of switch contacts, for example relays with 4 sets of changeover contacts are readily available.

The coil will be obvious and it may be connected either way round. Relay coils produce brief high voltage 'spikes' when they are switched off and this can destroy transistors and ICs in the circuit. To prevent damage you must connect a protection diode across the relay coil.

The relay's switch connections are usually labeled COM, NC and NO:

- **COM** = Common, always connect to this, it is the moving part of the switch.
- **NC** = Normally Closed, COM is connected to this when the relay coil is **off**.
- **NO** = Normally Open, COM is connected to this when the relay coil is **on**.
- Connect to COM and NO if you want the switched circuit to be **on when the relay coil is on**.
- Connect to COM and NC if you want the switched circuit to be **on when the relay coil is off**.

Choosing a relay:

You need to consider several features when choosing a relay:

1. Physical size and pin arrangement

If you are choosing a relay for an existing PCB you will need to ensure that its dimensions and pin arrangement are suitable. You should find this information in the supplier's catalogue.

2. Coil voltage

The relay's coil voltage rating and resistance must suit the circuit powering the relay coil. Many relays have a coil rated for a 12V supply but 5V and 24V relays are also readily available. Some relays operate perfectly well with a supply voltage which is a little lower than their rated value.

3. Coil resistance

The circuit must be able to supply the current required by the relay coil. You can use Ohm's law to calculate the current:

$$\text{Relay coil current} = \frac{\text{supply voltage}}{\text{coil resistance}}$$

For example: A 12V supply relay with a coil resistance of 400 Ohm passes a current of 30mA. This is ~~10~~OK for a 555 timer IC (maximum output

current 200mA), but it is too much for most ICs and they will require a transistor to amplify the current.

4. Switch ratings(voltage and current)

The relay's switch contacts must be suitable for the circuit they are to control. You will need to check the voltage and current ratings. Note that the voltage rating is usually higher for AC, for example: "5A at 24V DC or 125V AC".

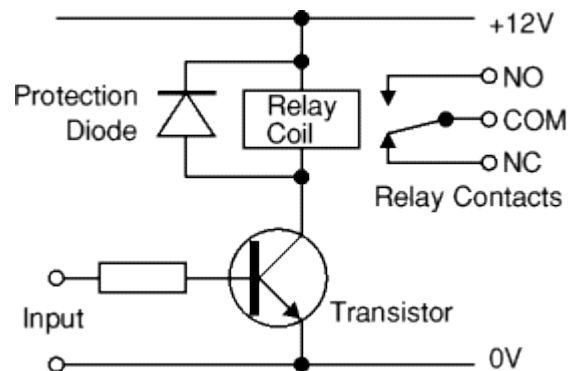
5. Switch contact arrangement(SPDT,DPDT etc)

Most relays are SPDT or DPDT which are often described as "single pole changeover" (SPCO) or "double pole changeover" (DPCO).

Protection diodes for relays

Transistors and ICs must be protected from the brief high voltage produced when a relay coil is switched off. The diagram shows how a signal diode (eg 1N4148) is connected 'backwards' across the relay coil to provide this protection.

Fig 6.3



Current flowing through a relay coil creates a magnetic field which collapses suddenly when the current is switched off. The sudden collapse of the magnetic field induces a brief high voltage across the relay coil which is very likely to damage transistors and ICs. The protection diode allows the induced voltage to drive a brief current through the coil (and diode) so the magnetic field dies away quickly rather than instantly. This prevents the induced voltage becoming high enough to cause damage to transistors and ICs.

Relays and transistors compared

Like relays, transistors can be used as an electrically operated switch. For switching small DC currents ($< 1A$) at low voltage they are usually a better choice than a relay.

However, transistors cannot switch AC (such as mains electricity) and in simple circuits they are not usually a good choice for switching large currents ($> 5A$). In these cases a relay will be needed, but note that a low power transistor may still be needed to switch the current for the relay's coil! The main advantages and disadvantages of relays are listed below:

Advantages of relays:

- Relays can switch **AC and DC**, transistors can only switch DC.
- Relays can switch **higher voltages** than standard transistors.
- Relays are often a better choice for switching **large currents** ($> 5A$).
- Relays can switch **many contacts** at once.

Disadvantages of relays:

- Relays are **bulkier** than transistors for switching small currents.
- Relays **cannot switch rapidly** (except reed relays), transistors can switch many times per second.
- Relays **use more power** due to the current flowing through their coil.
- Relays **require more current than many ICs can provide**, so a low power transistor may be needed to switch the current for the relay's coil.

DC MOTOR

DC motors are part of the electric motors using DC power as energy source. These devices transform electrical energy into mechanical energy. The basic principle of DC motors is same as electric motors in general, the magnetic interaction between the rotor and the stator that will generate spin.

Simple motor has six parts:

1. Armature or rotor
2. Commutator
3. Brushes
4. Axle

5. Field magnet
6. DC power supply of some sort

Brushless motor

A DC Brushless Motor uses a permanent magnet **external** rotor, three phases of driving coils, one or more Hall effect devices to sense the position of the rotor, and the associated drive electronics. The coils are activated, one phase after the other, by the drive electronics as cued by the signals from the Hall effect sensors, they act as three-phase synchronous motors containing their own variable frequency drive electronics.

CHAPTER – 5

SOFTWARE DESCRIPTION:

MPLAB IDE SOFTWARE:

MPLAB is a proprietary freeware [integrated development environment](#) for the development of [embedded applications](#) on [PIC](#) and [dsPIC microcontrollers](#), and is developed by [Microchip Technology](#).

MPLAB X is the latest edition of MPLAB, and is developed on the [NetBeans](#) platform. MPLAB and MPLAB X support project management, code editing, debugging and programming of Microchip 8-bit, 16-bit and 32-bit PIC microcontrollers.

MPLAB is designed to work with MPLAB-certified devices such as the [MPLAB ICD 3](#) and [MPLAB REAL ICE](#), for programming and debugging PIC microcontrollers using a [personal computer](#). [PICKit](#) programmers are also supported by MPLAB.

MPLAB 8.X is the last version of the legacy MPLAB IDE technology, custom built by Microchip Technology in Microsoft Visual C++. MPLAB supports project management, editing, debugging and programming of Microchip 8-bit, 16-bit and 32-bit PIC microcontrollers. MPLAB only works on Microsoft Windows. MPLAB is still available from Microchip's archives, but is not recommended for new projects.

MPLAB supports the following compilers:

- MPLAB MPASM Assembler
- MPLAB ASM30 Assembler
- MPLAB C Compiler for PIC18
- MPLAB C Compiler for PIC24 and dsPIC DSCs
- MPLAB C Compiler for PIC32
- HI-TECH C

MPLAB X is the latest version of the MPLAB IDE built by Microchip Technology, and is based on the open-source NetBeans platform. MPLAB X supports editing, debugging and programming of Microchip 8-bit, 16-bit and 32-bit PIC microcontrollers.

MPLAB X is the first version of the IDE to include cross-platform support for Mac OS X and Linux operating systems, in addition to Microsoft Windows.

MPLAB X supports the following compilers:

- MPLAB XC8 — C compiler for 8-bit PIC devices
- MPLAB XC16 — C compiler for 16-bit PIC devices
- MPLAB XC32 — C/C++ compiler for 32-bit PIC devices
- HI-TECH C — C compiler for 8-bit PIC devices
- SDCC — open-source C compiler.

HI-TECH C compiler for PIC10/12/16 MCUs (PRO):

This compiler has been discontinued and is no longer supported. This compiler has been replaced by the MPLAB® XC8 PRO (SW006021-2). HI-TECH C Compiler for PIC10/12/16 MCUs - PRO fully implements the optimizations of Omniscent Code Generation™ - a whole-program compilation technology - to provide denser code and better performance on PIC MCUs. This ANSI C compiler integrates into Microchips MPLAB(R) IDE and is compatible with Microchip debuggers and emulators.

CHAPTER – 6

REFERENCES

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ADVANTAGES

- No manual work
- Avoiding corruption
- Accurate result in the RTO office
- Time saving
- Avoiding accidents.

APPLICATION

- RTO Office

RESULT & DISCUSSION

There are three conditions to get driving license (i)to cover the complete path.(ii)do not ouch or

hit the edges(iii) speed of the vehicle must not to be zero. When all these condition are satisfy then the pass result will be displayed in the form of report, otherwise fail report will be generated.

CONCLUSION

A Driving License test automation system using RF Module based wireless acquisition is discussed. The usage of RFID based technology for skill assessment in the automated driving test process eliminates human intervention leaving no scope for manipulation and negotiation. Hence we can say that the system increases the level of transparency in the driving skill test process and decreases the rate of corruption in the process of issuing the driving license.

GEOTAGGED PHOTOS

HARDWARE DETAILS



RESULT OF THE PROJECT

