

TRANSCUTANEOUS ELECTRICAL NERVE STIMULATOR

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
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119**

APRIL 2021



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**DEPARTMENT OF ELECTRICAL AND ELECTRONICS
ENGINEERING**

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bona work of **AVINASH A** (Register No. **37140012**) & **JAYASURIYA K** (Register No. **37140038**) who carried out the project entitled "**TRANSCUTANEOUS ELECTRICAL NERVE STIMULATOR**" under our supervision from Dec. 2020 to March 2021.

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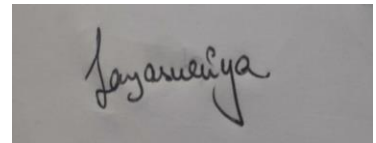
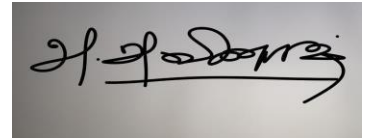
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DECLARATION

We **AVINASH A (Register No. 37140012) & JAYASURIYA K (Register No. 37140038)** hereby declare that the project report entitled “**TRANSCUTANEOUS ELECTRICAL NERVE STIMULATOR**” done by us under the guidance of Dr. **V.SENTHILNAYAGAM** is submitted in partial fulfillment of the requirements for the award of bachelor of engineering degree in electrical and electronics engineering.



SIGNATURE OF THE CANDIDATES

DATE: 14.4.2021

PLACE: CHENNAI

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We wish to express our thanks to all Teaching and Non-teaching staff members of the Department of Electrical and Electronics Engineering who were helpful in many ways for the completion of the project.

ABSTRACT

Transcutaneous electrical nerve stimulation (TENS) is a therapy that uses low-voltage electrical current for pain relief. TENS with a small, battery-powered machine about the size of a pocket radio. Usually, you connect two electrodes (wires that conduct electrical current) from the machine to your skin. The electrodes are often placed on the area of pain or at a pressure point, creating a circuit of electrical impulses that travels along nerve fibers.

When the current is delivered, some people experience less pain. This may be because the electricity from the electrodes stimulates the nerves in an affected area and sends signals to the brain that block or “scramble” normal pain signals. Another theory is that the electrical stimulation of the nerves may help the body to produce natural painkillers called endorphins, which may block the perception of pain.

TENS machine for different wavelength frequencies, such as a steady flow of electrical current or a burst of electrical current, and for intensity of electrical current. Your physical therapist, acupuncturist, or doctor usually determines these settings.

People use TENS to relieve pain for several different types of illnesses and conditions. They use it most often to treat muscle, joint, or bone problems that occur with illnesses such as osteoarthritis or fibromyalgia, or for conditions such as low back pain, neck pain, tendinitis, or bursitis. People have also used TENS to treat sudden (acute) pain, such as labor pain, and long-lasting (chronic) pain, such as cancer pain. TENS allow the user to select high-frequency stimulation (60 - 200Hz) or low-frequency stimulation (<10 Hz)..

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CHAPTER 1

INTRODUCTION

GENERAL INTRODUCTION

Cells and tissues of the body offer off electrical impulses within the vary of 0-100 cycle, as proven within the use of cardiography and diagnostic technique, once electrical impulses of low frequency, Example: fifty cycle, square measure applied to the body, one is working inside a pain sensation zone, as a result of the high resistance of the outer skin to those low-frequency current. because the frequency of this will increase, skin resistance decreases, however at high frequencies, wherever skin resistances (and pain) square measure low, the frequencies square measure too high to stimulate muscle, Interferential medical care may be a suggests that of healing scraped or abnormal tissue by generating an interesting current of a frequency within the bioelectric vary (0-100 Hz) inside the patient's tissues, Interferential medical care relies on the beat frequency phenomenon—when 2 MF currents of slightly totally different frequency see, the lower frequency is off out exploit a frequency response capable the distinction of the 2 frequencies. connective tissue electrical nerve stimulation, or TENS, may be a pain management technique that uses electricity to assist alleviate pain. TENS has been a unremarkably used pain management medical care virtually since it absolutely was initial developed within the late Nineteen Sixties. however like another therapies, TENS results aren't warranted — some individuals realize TENS a lot of useful than others. TENS treatment involves putting tiny electrodes, devices that conduct electricity, on the heal the a part of the body that is in pain; they're command in situ with adhesive. The electrodes square measure then connected to a machine that releases tiny waves of electricity, causing little electrical impulses through the electrodes to the painful joint or space of the body. TENS has been tried in a very range of conditions as a pain management tool.

TENS could also be accustomed ease pain from:

- Migraines and tension headaches
- Cancer pain
- Arthritis
- Bursitis
- Tendonitis
- Chronically painful injuries
- Pain after surgery

LITERATURE SURVEY:

1) Atamaz, F. C. et al. (2012). "Comparison of the efficacy of transcutaneous electrical nerve stimulation, interferential currents, and shortwave diathermy in knee osteoarthritis: a double-blind, randomized, controlled, multicenter study." Arch Phys Med Rehabil 93(5): 748-756.

To compare the effectiveness of transcutaneous electrical nerve stimulation (TENS), interferential currents (IFCs), and shortwave diathermy (SWD) against each other and sham intervention with exercise training and education as a multimodal package. The patients were randomized by the principal center into the following 6 treatment groups: TENS sham, TENS, IFCs sham, IFCs, SWD sham, and SWD. All interventions were applied 5 times a week for 3 weeks. In addition, exercises and an education program were given. The exercises were carried out as part of a home-based training program after 3 weeks' supervised group exercise. Primary outcome was a visual analog scale (0-100mm) to assess knee pain. Other outcome measures were time to walk a distance of 15m, range of motion, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Nottingham Health Profile, and paracetamol intake (in grams). We found a significant decrease in all assessment parameters ($P < .05$), without a significant difference among the groups except WOMAC stiffness score and range of motion. However, the

intake of paracetamol was significantly lower in each treatment group when compared with the sham groups at 3 months ($P<.05$). Also, the patients in the IFCs group used a lower amount of paracetamol at 6 months ($P<.05$) in comparison with the IFCs sham group.

2) Beatti, A. et al (2010). "The analgesic effect of interferential therapy on clinical and experimentally induced pain." *Physical Therapy Reviews* 15: 243-252.

Interferential therapy (IFT) is one of the most popular modalities used by physiotherapists for the management and control of pain. Despite its widespread use, there remains debate surrounding its effectiveness. Objectives: The aim of this systematic review was to evaluate the published literature on the effectiveness of IFT in reducing pain. Method: A literature search of Cochrane Central Register of Controlled Trials, Medical Literature Analysis and Retrieval System Online (MEDLINE), Cumulative Index to Nursing and Allied Health Literature (CINAHL), Excerpta Medica Database (EMBASE), and Physiotherapy Evidence Based (PEDro) was performed. This review adhered only to randomised controlled trials (RCTs) that investigated IFT in the presence of a control group. PEDro scale was used to assess the methodological quality of the included studies. Results: Nine RCTs met the inclusion criteria of this review. One study evaluated the effect of IFT on clinical pain while remaining studies examined induced pain including thermal (cold and hot), ischemic, mechanical, and delayed onset of muscle soreness. No clear conclusion was withdrawn regarding the effectiveness of IFT on pain management due to the high variability in study design and deficiencies in methodological quality. The data were limited and contradicting and therefore, of equivocal support to the pain reduction effect of IFT. Conclusion: There is inadequate evidence to support the effectiveness of IFT in pain management. Clearly, there is a need for RCTs with high methodological quality to establish IFT efficacy.

3) Bellew, J. W., Z. Beiswanger, et al. (2012). "Interferential and burst-modulated biphasic pulsed currents yield greater muscular force than Russian current." *Physiotherapy Theory and Practice* 28(5): 384-390.

Previous data regarding neuromuscular electrical stimulation (NMES) have suggested that muscle torque production with interferential current (IFC) is inferior to Russian current; however, waveform parameters specific and critical to NMES were inconsistent, making interpretation of previous findings precarious. The purpose of this investigation was to compare muscle force production of three electrical stimulating waveforms when using equivalent stimulus parameters. The percent of maximal voluntary isometric knee extensor force (%MVIF) elicited using interferential, Russian, and burst-modulated biphasic pulsed currents were compared in 23 healthy college-aged subjects. A repeated measures single factor design in a university laboratory setting was used. A significant effect for waveform used was noted. Data showed significantly greater %MVIF of the knee extensors were obtained using IFC or burst-modulated BP current versus conventional Russian current.

4) Fuentes, J. P. et al (2010). "Effectiveness of Interferential Current Therapy in the Management of Musculoskeletal Pain: A Systematic Review and Meta-Analysis." Phys Ther 90(9): 1219-1238.

Interferential current (IFC) is a common electrotherapeutic modality used to treat pain. Although IFC is widely used, the available information regarding its clinical efficacy is debatable. The aim of this systematic review and meta-analysis was to analyze the available information regarding the efficacy of IFC in the management of musculoskeletal pain. Randomized controlled trials were obtained through a computerized search of bibliographic databases (ie, CINAHL, Cochrane Library, EMBASE, MEDLINE, PEDro, Scopus, and Web of Science) from 1950 to February 8, 2010. Two independent reviewers screened the abstracts found in the databases. Methodological quality was assessed using a compilation of items included in different scales related to rehabilitation research. The mean difference, with 95% confidence interval, was used to quantify the pooled effect. A chi-square test for heterogeneity was performed. A total of 2,235 articles were found. Twenty studies fulfilled the inclusion criteria. Seven articles assessed the use of IFC on joint pain; 9 articles evaluated the use of IFC on muscle pain; 3 articles evaluated its use on soft tissue shoulder pain; and 1 article examined its use on postoperative pain. Three of the 20 studies were considered to be of high methodological quality, 14 studies

were considered to be of moderate methodological quality, and 3 studies were considered to be of poor methodological quality. Fourteen studies were included in the meta-analysis.

5) Fuentes, C. J. et al (2010). "Does amplitude-modulated frequency have a role in the hypoalgesic response of interferential current on pressure pain sensitivity in healthy subjects? A randomised crossover study " *Physiotherapy* 96(1): 22-29.

To investigate the hypoalgesic effect of amplitude-modulated frequency during interferential current therapy using an experimentally induced mechanical pain model in normal subjects. This study examined pain pressure sensitivities achieved when the amplitude-modulated frequency parameter was present (100Hz) and absent (0Hz). Randomised controlled crossover trial with repeated measures. Two interferential therapy protocols (with and without amplitude-modulated frequencies) were applied to the lumbar area on two different days. Pressure pain thresholds over the lumbar area were measured before, during and after application of the interferential therapy protocols. A three-way analysis of variance with repeated measures failed to show any statistically significant difference between the two protocols in modifying pressure pain threshold values (mean difference 0.017kg/cm(2), 95% confidence interval -0.384 to 0.350, $P=0.93$). Statistically significant differences were identified ($P<0.001$) between measurements, indicating a comparable decrease in pain sensitivity in both groups. However, the increase in pressure pain thresholds (0.76kg/cm(2)) failed to reach a level of clinical importance.

SCOPE OF THE PROJECT

TENS could be a non-invasive technique for relieving pain. those that expertise pain relief from TENS is also ready to scale back their intake of pain medications, a number of which might be addictive or cause adverse aspect effects.

TENS units also are convenient as a result of they're tiny, portable, and comparatively distinct. folks will carry a TENS unit in their pocket or clip it onto a belt to make sure that they need immediate access to pain relief throughout the day.

EXISTING PAIN RELIEF THERAPY

ULTRASOUND THERAPY

Ultrasound medical care could be a treatment modality utilized by physical therapists or activity therapists to treat pain conditions and to market tissue healing. whereas ultrasound medical care isn't effective for all chronic pain conditions, it's going to facilitate scale back your pain if you have got any of the following:

- Osteoarthritis
- Myofascial pain
- Bursitis
- Carpal tunnel syndrome
- Pain caused by scar tissue
- Phantom limb pain
- Sprains and strains

Types of Ultrasound Therapy

Types of Ultrasound medical care Their square measure 2 main sorts of ultrasound therapy: thermal and mechanical. each use sound waves generated by a electrical device head (which appearance a touch sort of a microphone) to penetrate soft tissues. The distinction between the 2 sorts of ultrasound medical care is that the rate at that the sound waves penetrate the tissues.

- **Thermal ultrasound therapy.** Thermal ultrasound treatment uses a many continuous transmission of sound waves. The sound waves cause microscopic vibrations within the deep tissue molecules, increasing heat and friction. The warming result encourages healing within the soft tissues by increasing the metabolism at the extent of the tissue cells.

- **Mechanical ultrasound therapy.** Mechanical ultrasound medical care uses pulses of sound waves to penetrate tissues. whereas this still incorporates a minor warming result on the tissues, it additionally causes enlargement and contraction within the little gas bubbles of the soft tissues. This helps to decrease the inflammatory response, reducing tissue swelling and therefore decreasing pain.

The type of ultrasound medical care you receive depends on your condition. If you have got myofascial pain, or had a muscle strain or sprain that has not cured, your healer can probably use thermal ultrasound medical care. If your pain is caused by connective tissue or swelling, like with carpal tunnel syndrome, you will profit a lot of from mechanical ultrasound medical care.

ELECTRICAL MUSCLE STIMULATOR

Transcutaneous electrical nerve stimulation, or TENS, may be a pain management technique that uses electricity to assist alleviate pain. TENS has been a unremarkably used pain management medical aid virtually since it had been initial developed within the late Nineteen Sixties. however like another therapies, TENS results aren't warranted some folks realize TENS additional useful than others.

TENS treatment involves putting tiny electrodes, devices that conduct electricity, on the heal the a part of the body that is in pain; they're control in situ with adhesive. The electrodes area unit then hooked up to a machine that releases tiny waves of electricity, causation small electrical impulses through the electrodes to the painful joint or space of the body.

TENS has been tried in a number of conditions as a pain management tool. TENS may be used to ease pain from:

- Migraines and tension headaches
- Cancer pain

- Arthritis
- Bursitis
- Tendonitis
- Chronically painful injuries
- Pain after surgery
- Pain during childbirth

SHORT WAVE DIATHERMY

Diathermy may be a therapeutic modality that's most typically used for joint conditions like rheumatism and arthritis. The term modality refers to the creation of warmth exploitation electrical pulses. In modality, a high-frequency current is delivered via shortwave, microwave, or ultrasound that is ready to get deep heat in body tissues. the warmth are often accustomed improve circulation and/or to alleviate pain. additionally, shortwave modality are often employed in medication for treating broken tissues and reposeful muscles.

The electric pulse of Short-Wave modality creates heat deep within a targeted tissue, reaching areas as deep as 2 inches from the skin's surface. whereas the medical instrument doesn't apply heat on to the body, this created by the machine permits the body to come up with heat at intervals the targeted space itself.

It is once the warmth of the world will increase, that blood flow is improved along side enhancements to flexibility in stiff joints and animal tissue creating it a decent option to use for patients with inflammatory disease.

The main edges for faded pain and inflammation is it permits patients to softly increase their vary of motion permitting them to maneuver with additional ease and participate in rehabilitation with additional comfort.

Diathermy isn't simply employed in rehabilitation. modality will be employed in surgical procedures wherever once the conductor will be applied to a vessel. the warmth generated by modality within the vessel can cause the blood to coagulate permitting the vessel to be cauterize(seal).

Diathermy also can be wont to take away abnormal growths, like tumors, particularly in procedures wherever ancient techniques square measure impractical. for instance, surgical modality will be wont to address problems within the prostate, bladder, cervix, brain, ovaries, bowels, eyes, and tonsils.

Short wave modality may be a distinguished kind of modality (different than ultrasound and microwave) that involves causation high-frequency waves throughout the patient's body and into the affected tissues. The energy waves ar sent from condenser plates set on either facet of the tissue being treated. Typical radio radiation modality machines operate at a frequency of twenty seven.33 rate and have wave lengths of eleven meters.

CHAPTER 2

PROJECT DESCRIPTION

Block diagram of transcutaneous electrical nerve stimulator

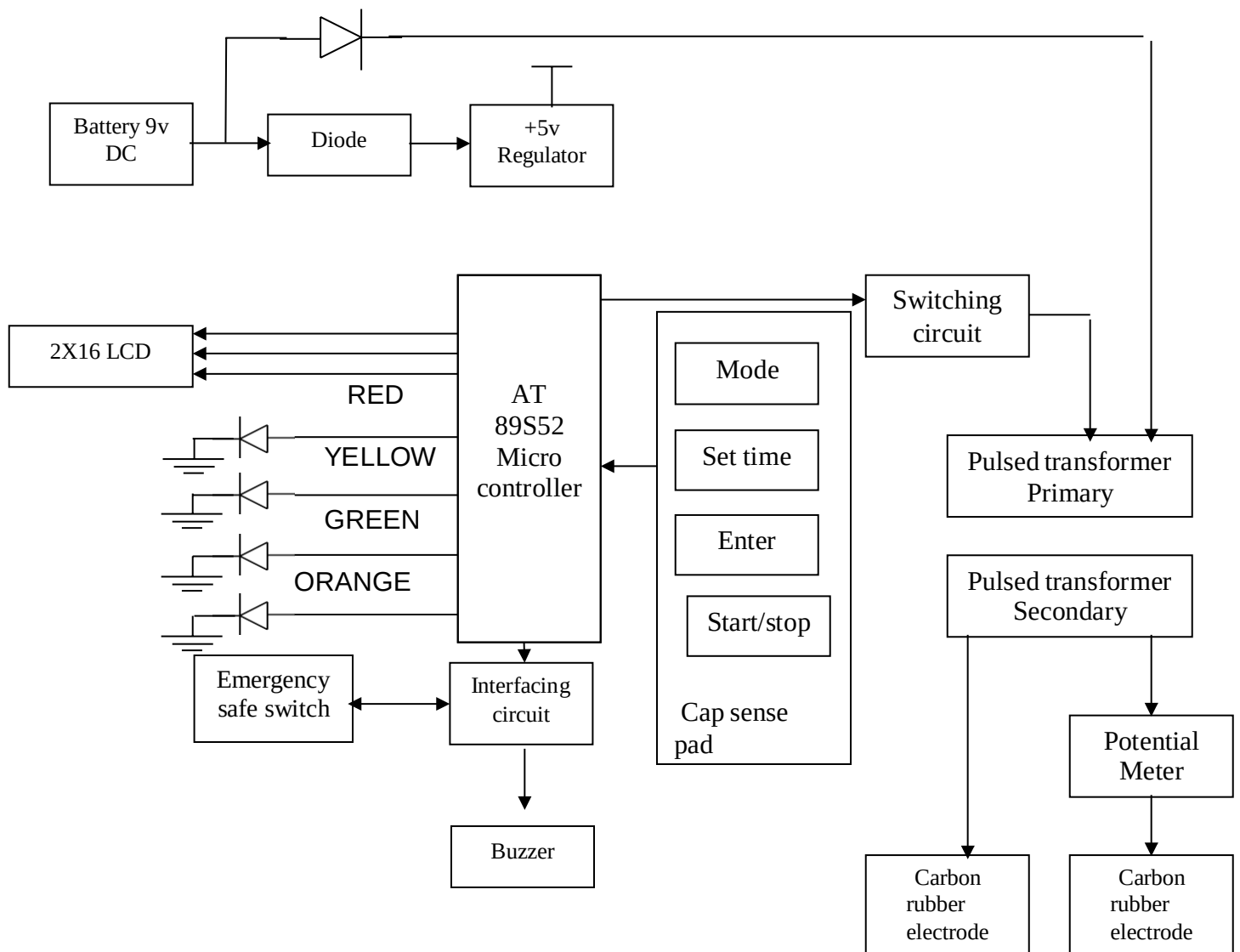


Fig 2.1 Block diagram of transcutaneous electrical nerve stimulator

Battery can give the 9v to the transformer. PN (IN4007) diode can be used to maintain the balance current between the elements. The step up transformer give the pulsated variable voltage. It can also convert the dc source into ac source. Switching circuit involves the transistor of (BC368) The features of this transistor allows high current than the other transistor. In the Potential meter the variable resistor is connected from that we can vary the current. The carbon rubber electrodes are placed on the skin. Instead of carbon, we may also use the surface electrode. The micro controller (AT89S52) provides the mode selection First it reads the input from the user. Then it displays the corresponding input on the LCD. The micro controller (AT89S52) provides the mode selection. The micro controller (AT89S52) provides the mode selection. First it reads the input from the user. Then it displays the corresponding input on the LCD. After that it obtains the entry command from us. Finally it generates the PWM wave. By using capsences we can select the modes. In this we use the UART communication for reliability. When we select the emergency mode, the entire system stops the current flow and the buzzer gets alarm. The interfacing unit has the transistor which act as a switching unit. The LED is used to indicate the operation of the modes .Red -for emergency.

Green -pulse is going on.

Yellow –pulse is generating while shocking.

Orange-On and Off purpose(based on time).

LCD(2*16) –two lines and 16 characters per line is used to display the input.

Power to all provides 5v to all the devices.

CIRCUIT DIAGRAM

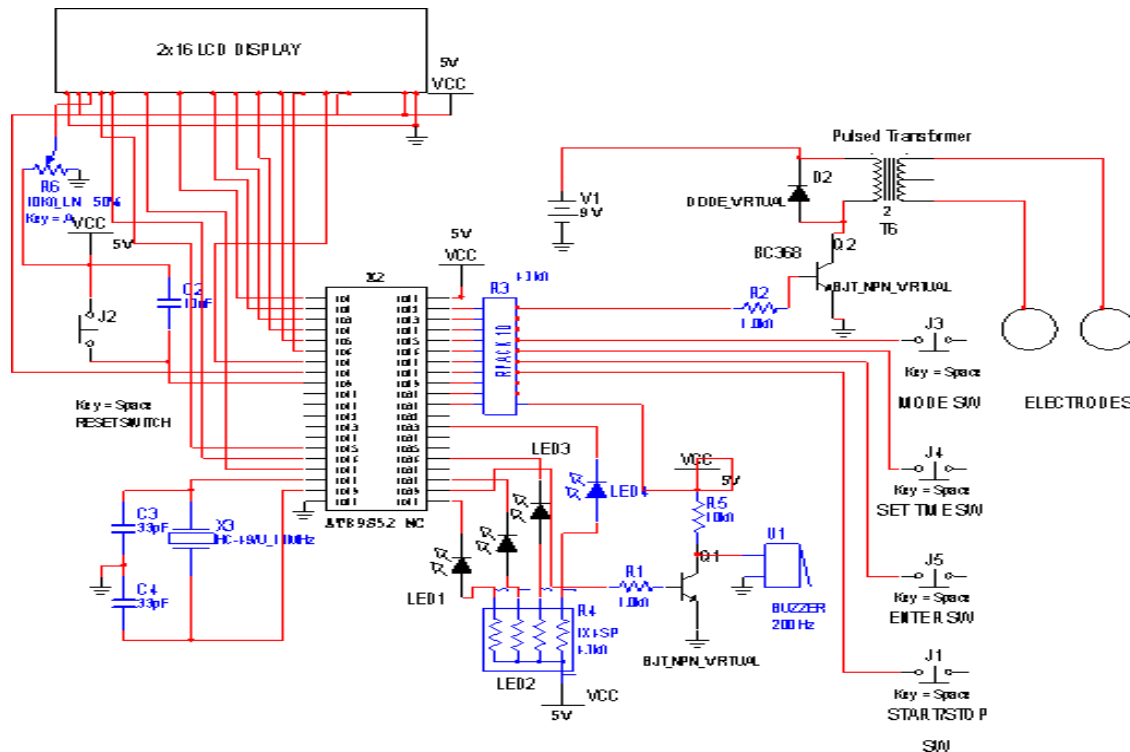


Fig 2.2 CIRCUIT DIAGRAM

COMPONENTS REQUIRED

2.3.1HARDWARE REQUIRED:

- Microcontroller and power supply Unit
- Display Unit
- Control Unit
- Buzzer
- Carbon Electrodes

- Capsences pad

SOFTWARE REQUIRED:

- Embedded C language
- KEIL Cross Compiler

WORKING PROCEDURE:

BLOCK DIAGRAM FOR VARYING FREQUENCY

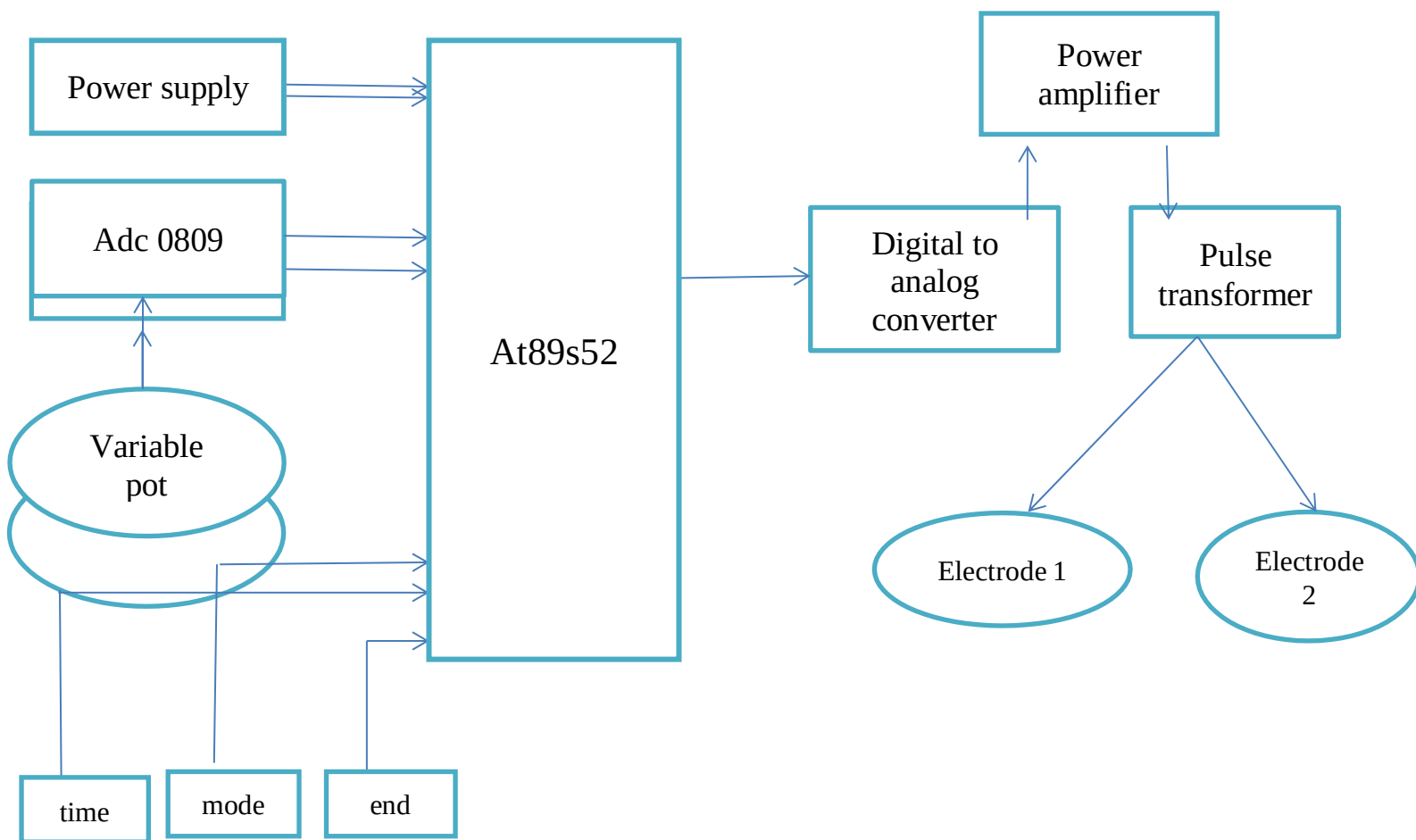


Fig 2.3 BLOCK DIAGRAM FOR VARYING FREQUENCY

BLOCK DIAGRAM FOR FIXED FREQUENCY

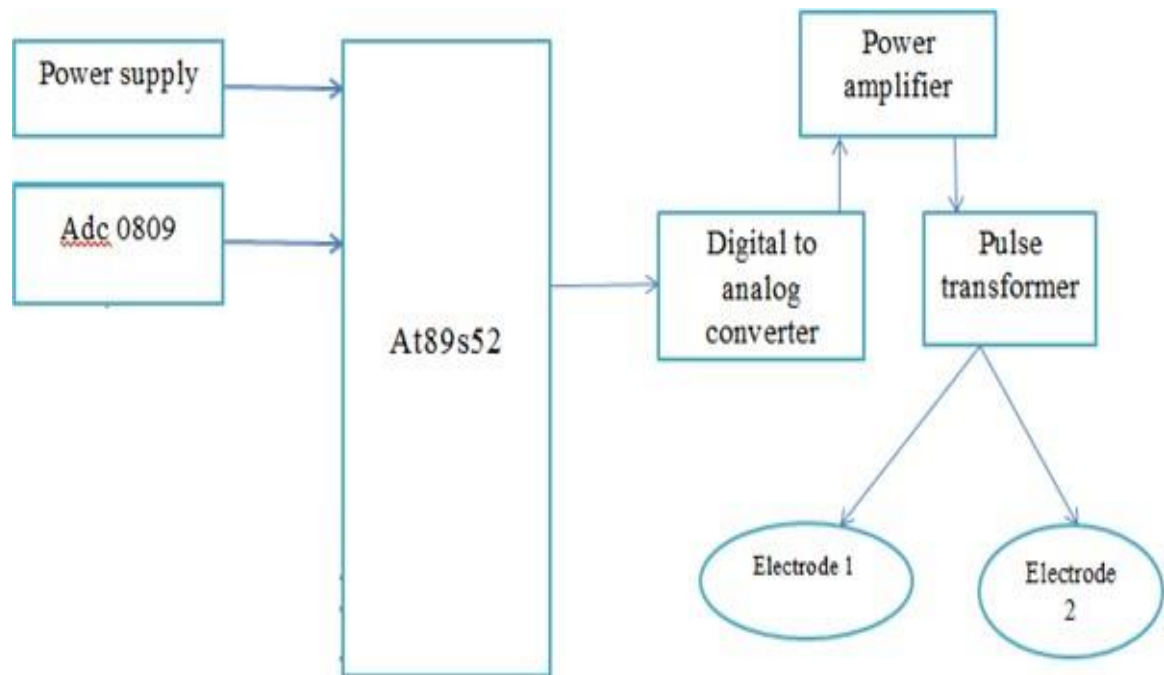


Fig 2.4 BLOCK DIAGRAM FOR FIXED FREQUENCY

Principles

To produce low frequency effects at ample intensity and at ample depth, patients will expertise respectable discomfort within the superficial tissues (i.e. the skin). this can be thanks to the electrical phenomenon of the skin being reciprocally proportional to the frequency of the stimulation. [The barrier conferred by the skin to the passage of an electrical current is additional complicated than simply electrical phenomenon, or resistance, however are considered such for the aim of this explanation] In alternative words, the lower the stimulation frequency, the bigger the electrical phenomenon to the passage of the present & thus, additional discomfort is practiced because the current is

'pushed' into the tissues against this barrier. The skin electrical phenomenon at 50Hz is roughly 3200 while at 4000Hz it's reduced to roughly 40. The results of applying the next frequency is that it'll pass additional simply through the skin, requiring less electricity input to succeed in the deeper tissues & giving rise to less discomfort.

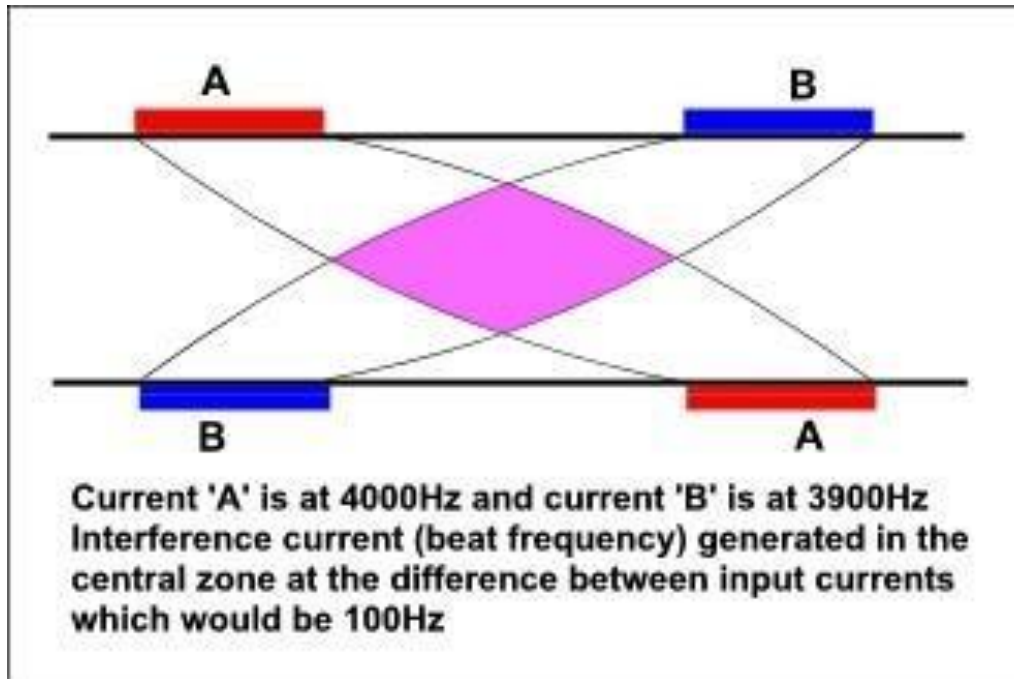


Fig 2.5 Interference current generated

The effects of tissue stimulation with these 'medium frequency' currents (medium frequency in electromedical terms is typically thought-about to be 1KHz-100KHz) has nonetheless to be established. it's unlikely to try and do nothing the least bit, however in terms of current apply, very little is understood of its physiological effects. it's powerless of direct stimulation of nerve within the common context of such stimulation, tho' some researchers square measure presently work this space.

Interferential medical aid utilises 2 of those MF currents, more established the tissues at the same time, wherever they're established in order that their methods cross & they virtually interfere with one another – thence another term that has been employed in the past however seems to be out of favour at the instant – Interference Current medical aid. This interaction provides rise to Associate in Nursing interference current (or beat

frequency) that has the characteristics of low frequency stimulation – in impact the interference mimics an occasional frequency stimulation.

The exact frequency of the resultant beat frequency are often controlled by the input frequencies. If as an example, one current was at 4000Hz and its companion current at 3900Hz, the resultant beat frequency would be at 100Hz, carried on a MF 3950Hz amplitude modulated current.

By careful manipulation of the input currents it's doable to realize any beat frequency that you just would possibly want to use clinically. fashionable machines typically provide frequencies of 1-150Hz, tho' some provide a alternative of up to 250Hz or a lot of. To a bigger extent, the expert doesn't ought to concern themselves with the input frequencies, however merely with the acceptable beat frequency that is chosen directly from the machine.

The magnitude of the low frequency interference current is (in theory) or so corresponding to the add of the input amplitudes. it's tough to indicate flatly that this can be the case within the tissues however it's affordable to counsel that the resultant current are stronger than either of the two input currents.

The use of two pole IFT stimulation is created doable by electronic manipulation of the currents - the interference happens within the machine rather than within the tissues. there's no better-known physiological distinction between the consequences of IFT made with two or four conductor systems. The key distinction is that with a four pole application the interference is generated within the tissues and with a two pole treatment, this is 'pre modulated' i.e. the interference is generated at intervals the machine unit (Ozcan et al, 2004).

Whichever approach it's generated, the treatment impact is generated from low frequency stimulation, primarily involving the peripheral nerves. There might so be important impact on tissue apart from nerves, however they need not until now been without ambiguity incontestable. Low frequency nerve stimulation is physiologically effective (as with TENS and NMES) and this can be the key to IFT intervention.

2.5.1 Frequency Sweep

Nerves can accommodate to a relentless signal & a sweep (or bit by bit ever-changing frequency) is usually wont to overcome this drawback. The principle of victimisation the sweep is that the machine is about to mechanically vary the effective stimulation frequency victimisation either pre-set or user set sweep ranges. The sweep vary used ought to be acceptable to the specified physiological effects (see below). it's been repeatedly incontestable that 'wide' sweep ranges square measure ineffective whenever they need been tested or evaluated within the clinical surroundings

The pattern of the sweep makes a big distinction to the stimulation received by the patient. Most machines supply many sweep patterns, although there's terribly restricted 'evidence' to justify a number of these choices. within the classic 'triangular' sweep pattern, the machine bit by bit changes from the bottom to the highest frequency, sometimes over a period of six seconds – although some machines supply one or three second choices. within the example illustrated, the machine is about to brush from ninety to 130Hz using a triangular sweep pattern. All frequencies between the bottom and high frequencies square measure delivered in equal proportion.

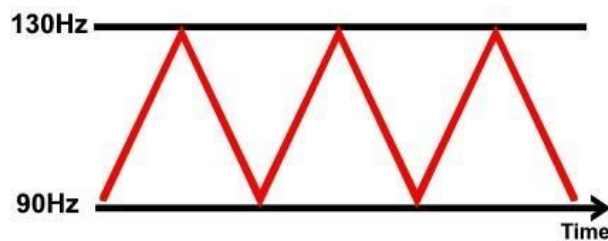


Fig 2.6 Triangular sweep pattern

Other patterns of sweep are often made on several machines, for instance an oblong (or step) sweep. This produces a really totally different stimulation pattern in this the bottom and prime frequencies area unit set, however the machine then 'switches' between these 2 specific frequencies instead of bit by bit dynamical from one to the opposite. The adjacent diagram illustrates the result of setting a ninety – 130Hz rectangular sweep.

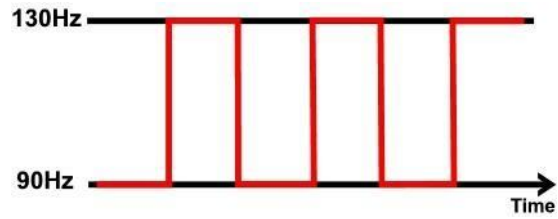


Fig 2.7 Rectangular sweep pattern

There is a transparent distinction between these examples – although a similar ‘numbers’ are set. One can deliver a full vary of stimulation frequencies between the set frequency levels and therefore the alternative can switch from one frequency to the opposite. There are various alternative variations on this theme, and therefore the ‘trapezoidal’ sweep is effectively a mixture of those 2.

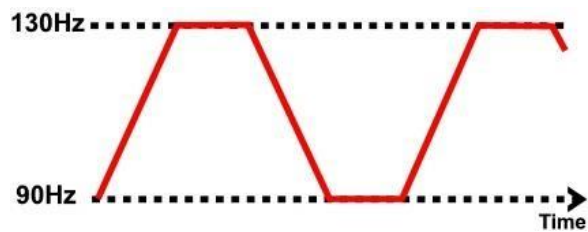


Fig 2.8 Trapezoidal sweep pattern

The only sweep pattern that 'evidence' seems to exist is that the triangular sweep. The others square measure absolutely safe to use, however whether or not they square measure clinically effective or not remains to be shown.

Physiological Effects & Clinical Applications

It has been urged that IFT works in an exceedingly 'special way' as a result of it's 'interferential' as hostile 'normal' stimulation. The proof for this effect is lacking and it's possibly that IFT is simply another means that by that peripheral nerves are often stirred. it's rather a generic means that of stimulation – the machine are often got wind of to act a lot of sort of a TENS kind device or are often got wind of to behave a lot of sort of a muscle stimulator – by adjusting the stimulating (beat) frequency. it's usually regarded (by patients) to be a lot of acceptable because it generates less discomfort than another sorts of electrical stimulation.

The clinical application of IFT medical aid is predicated on peripheral nerve stimulation (frequency) information, although it's vital to notice that abundant of this data has been generated from analysis with alternative modalities, and its transfer to IFT is assumed instead of well-tried. there's a scarcity of IFT specific analysis compared with alternative modalities (e.g. TENS).

Selection of a good frequency sweeps has been thought of less economical than a smaller selective home in that by treating with a frequency vary of say 1-100Hz, the effective treatment frequencies are often lined, however just for a comparatively little share of the whole treatment time. to boot, some components of the vary can be harmful for the first aims of the treatment.

Clinical Application

There are 4 main clinical applications for which IFT appears to be used:

Pain relief

Muscle stimulation

Increased local blood flow

Reduction of oedema

In addition, claims square measure created for its role in stimulating healing and repair and for numerous specialised application – e.g. enuresis, tho' for the previous examples (healing and repair) there's a lack of quality analysis data out there.

As IFT acts totally on the excitable (nerve) tissues, the strongest effects square measure possible to be those that square measure an on the spot results of such stimulation (i.e. pain relief and muscle stimulation). the opposite effects square measure additional possible to be secondary consequences of those.

Pain Relief:

Electrical stimulation for pain relief has widespread clinical use, though the direct analysis proof for the utilization of IFT during this role is restricted. Logically one might use the upper frequencies (90-130Hz) to stimulate the pain gate mechanisms & thereby mask the pain symptoms. as an alternative, stimulation with lower frequencies (2-5Hz) will be accustomed activate the opioid mechanisms, once more providing a degree of relief. These 2 totally {different completely different} modes of action will be explained physiologically & can have different latent periods & variable period of impact. It remains attainable that relief of pain is also achieved by stimulation of the RF at frequencies of 10-25Hz or by interference C fiber transmission at >50Hz. though each of those latter mechanisms are planned (theoretically) with IFT, neither are unconditionally incontestable.

A good range of recent studies (e.g. Hurley et al 2004, Johnson and Tabassum 2003, Walker et al 2006, McManus et al 2006, Jorge et al 2006, Gundog et al 2012, Rocha 2012, Ataman et al 2012) offer substantive proof for a pain relief impact of IFT.

Muscle Stimulation:

Stimulation of the motor nerves is achieved with a large vary of frequencies. Clearly, stimulation at low frequency (e.g. 1Hz) can end in a series of twitches, long whist stimulation at 50Hz can end in a tetanic contraction. there's restricted proof at the moment for the 'strengthening' impact of IFT (though this proof exists for a few alternative kinds of electrical stimulation), tho' the paper by Bircan et al (2002) suggests that it would be an opening. On the idea of the present proof, the contraction caused by IFT isn't any 'better' than would be achieved by active exercise, tho' there are clinical circumstances wherever motor-assisted contraction is helpful. for instance to help the patient to understand the muscle work needed (similar to surged Faradism used antecedently – however a lot of less uncomfortable). For patients World Health Organization cannot generate helpful voluntary contraction, IFT could also be useful because it would be for people who, for no matter reason, realize active exercise troublesome. there's no proof that has incontestable a major advantage of IFT over active exercise. Bellew et al (2012) evaluated the stimulatory effects of IFT and numerous Burst Mode currents in terms of their capability to get vital quality contraction, the results were ancillary of IFT as a treatment choice.

The choice of treatment parameters can rely upon the required impact. the foremost effective nervus stimulation vary with IFT seems to lie between roughly ten and twenty, perhaps ten and 25Hz. Stimulation below 10Hz ends up in a series of coarse twitches which can be of clinical profit, tho' it's however to be unambiguously incontestable with IFT. Stimulation at higher frequencies than that required to give birth to a partial apyretic tetanus (usually around twenty or 25Hz) will generate a robust tetanic contraction, which could be thought of useful to help patient appreciation of the specified muscle work, but again, in terms of IFT intervention, it's however to be incontestable that this contraction level is required over and on top of a partial apyretic tetanus.

Caution ought to be exercised once using IFT as a way to get clinical levels of contraction therein the muscle can still work for the length of the stimulation amount (assuming spare current strength is applied). it's potential to still stimulate the muscle on the far side its purpose of fatigue – the contractions ar forced via the nervus – and short stimulation periods with adequate rest could be a preferred choice. Some IFT devices ar capable of generating a 'surged' stimulation mode which could be advantageous therein fatigue would be minimized – this surged intervention would be similar, however more well-off than Faradism.

Blood flow

There is little, if any quality proof demonstrating an instantaneous result if IFT on native blood flow changes. Most of the work that has been done involves laboratory experimentation on symptomless subjects, and most blood flow measurements area unit superficial i.e. skin blood flow. whether or not IFT is really capable of generating a modification (increase) in blood flow at depth remains questionable. The elegant experimentation by Noble et al (2000) incontestable tube-shaped structure changes at 10–20Hz, tho' was unable to obviously determine the mechanism for this transformation. The stimulation was applied via suction electrodes, and {therefore the|and also the} outcome may therefore be as a results of the suction instead of the stimulation, tho' this can be for the most part negated by virtue of the actual fact that different stimulation frequencies were additionally delivered with the suction electrodes while not the blood flow changes. the foremost seemingly mechanism is via muscle stimulation effects (IFT inflicting shortening that brings a couple of native metabolic and so tube-shaped structure change). risk|the likelihood|the chance} that the IFT is acting as associate substance or sympathetic activity remains a theoretical possibility instead of a longtime mechanism. Based on current obtainable proof, the foremost seemingly possibility for IFT use as a method to extend native blood flow remains via the muscle stimulation mode, and so the 10-20 or 10-25Hz frequency sweep choices seems to be the foremost seemingly helpful possibility.

Oedema

IFT has been claimed to be effective as a treatment to push the resorption of dropsy within the tissues. Again, the proof is extremely restricted during this respect and therefore the physiological mechanism by that is might be achieved as an on the spot impact of the IFT remains to be established. The preferred clinical choice within the lightweight of the accessible proof is to use the IFT to cause native muscle contraction(s) that combined with the native tube changes which will result (see above) might be effective in encouraging the resorption of tissue fluid. the utilization of suction electrodes is also helpful, however additionally remains unverified during this respect.

A study by Jarit et al (2003) incontestable a modification in dropsy following knee surgery in associate degree IFT cluster, although the patients did the circumferential knee measures (rather than the therapist) associate degreed circumferential knee measuring isn't an particularly reliable technique for characteristic dropsy intrinsically. The Christie and Willoughby study (1990) did not demonstrate a major profit on articulatio talocrural is dropsy following fracture and surgery. The treatment parameters used area unit unlikely to be effective given the data currently accessible. If IFT encompasses a capability to influence dropsy, this proof and physiological information would recommend that a mixture of pain relief (allowing a lot of movement), muscle stimulation (above) and increased native blood flow (above) is that the presumably combination to be best.

Other Clinical Applications

In addition to the four key areas known on top of, there ar many different specialist application that IFT has been utilized. These embrace stimulation as a part of the management of incontinence and girdle floor coaching (e.g. Parkkinen et al, 2004), constipation in youngsters (Chase et al, 2005, Queratto et al 2013, Yik et al 2012), Fibromyalgia (Almedia et al, 2003; Raimundo et al, 2004) and trigger purpose intervention (Hou, 2002; Jenson et al, 2002). improvement of fracture healing has additionally been investigated with mixed results (e.g. Ganne, 1988)

Treatment Parameters:

Stimulation may be applied mistreatment pad electrodes and sponge covers (which once wet give an inexpensive conductive path), tho' electroconductive gel is an efficient different. The sponges ought to be totally wet to confirm even current distribution. Self adhesive pad electrodes also are accessible (similar to the newer TENS electrodes) and build the IFT application easier within the read of the many practitioners. The suction conductor application methodology has been in use for many years, and while it's helpful, particularly for larger body areas just like the arch, trunk, hip, knee, it doesn't seem to produce any therapeutic advantage over pad electrodes (in alternative words, the suction element of the treatment doesn't seem to possess a measurable therapeutic effect). Care ought to be crazy regards maintenance of electrodes, conductor covers and associated infection risks (Lambert et al 2000).

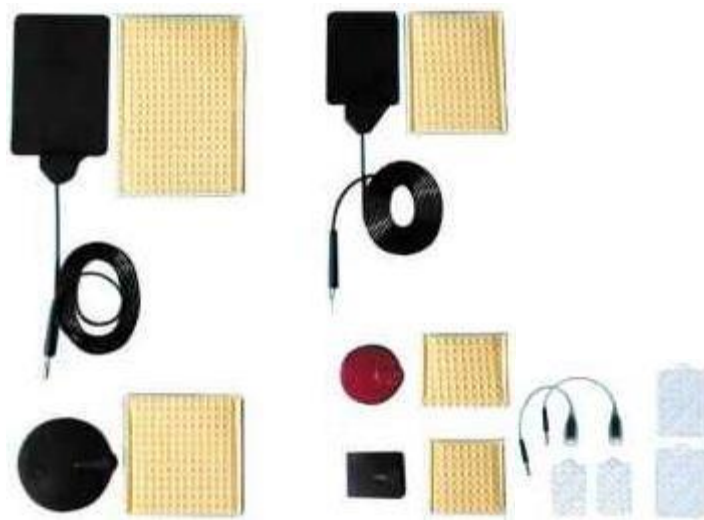


Fig 2.9 Electrodes & Sponge covers



Fig 2.10 Electrode Connected With Device

Whichever conductor system is used, conductor positioning ought to guarantee adequate coverage of the wound for stimulation. Exploitation of larger electrodes can minimise patient discomfort while tiny, closely spaced electrodes increase the danger of superficial tissue irritation and attainable injury / skin burn.

The bipolar (2 pole) application methodology is utterly acceptable, and there's no physiological distinction in treatment outcome despite many anecdotal stories to the contrary. Recent analysis proof supports the good thing about two pole application (e.g. Ozcan et al 2004).

Treatment times vary wide in keeping with the standard clinical parameters of acute/chronic conditions & the sort of physiological impact desired. In acute conditions, shorter treatment times of 5-10 minutes could also be sufficient to realize the impact. In alternative circumstances, it should be necessary to stimulate the tissues for 20-30 minutes. It's prompt that short treatment times square measure at first adopted particularly with the acute case just in case of symptom exacerbation. These may be progressed if the aim has not been achieved and no untoward aspect effects are created. There's no

analysis proof to support the continual progression of a treatment dose so as to extend or maintain its impact.

AMF

The AMF are often set as desired in line with the kind, stage, severity and site of the condition to be treated. The sensations told by the patient at the varied AMF's have to be compelled to be thought-about. High frequencies square measure told as 'more comfortable', 'pleasanter' or 'lighter'. A high AMF (80-200 Hz) is advised(5) for acute conditions, nice pain and hypersensitivity. A high AMF is additionally preferred for initial treatment if the patient shows a concern of electricity. At low frequencies the feeling is 'rougher', 'deeper' or 'stronger'. Frequencies below fifty cycle will simply cause (tetanic) contractions. In less acute cases, (i.e.) less pain and lower sensibility conditions, and wherever muscle contractions square measure needed, a low AMS is most fitted.

Choice of electrodes

In addition to the same old (flat) conductors there's additionally some extent electrode. This conductor is specifically supposed for the detection and treatment of pain points. it's employed in combination with a bigger 'indifferent' conductor that is placed well aloof from the affected space. the purpose conductor can't be used with the four-pole technique.

Electrode positioning (or) Accommodation

The electrodes should be positioned in such the way that the patient experiences the stimulation within the affected space. his ought to be checked throughout treatment, and therefore the electrodes ought to be repositioned as necessary. this is applicable to each the two-pole and therefore the four-pole methodology. it's documented that, once a current has been set, the patient can feel the information less clearly once a amount of your time ,or even utterly stop to feel it. This result is named as accommodation, and is thanks to the very fact that a hard and fast frequency the excited sensors can step by

step transmit less data to the central systema nervosum. Thus, if the information remains unchanged, its result can quieten down. Accommodation should thus be prevented.

There are three ways of preventing **accommodation**:

Increasing the amplitude:

The possibility of strong tetanic contractions must be taken into account. These can be unpleasant for the patient.

Varying the frequency (the 'Frequency Modulation'):

Bernard was the first to use this method of preventing accommodation, in the form of the CP and LP currents. Here, there is a rhythmic alternation of 50 Hz and 100 Hz frequencies. The same principle is used in interferential therapy ,in the form of 'Frequency Modulation' .

The following parameters are of importance:

a. The width of the Frequency Modulation

A 'broad' modulation (i.e. an outsized frequency range) is healthier for preventing accommodation than a 'narrow 'Frequency Modulation (i.e. a little frequency range); the massive changes in frequency with a broad Frequency Modulation end in powerfully variable sensations and/or contractions.

b. The Frequency Modulation mode (Frequency Modulation variation or Frequency Modulation sweep)

Depending on the equipment used, there are various ways of indicating the ratio between the base AMF and the

Frequency Modulation (in seconds). Examples are: 1/1, 1/5/1/5, 6/6 and 1/30/1/30

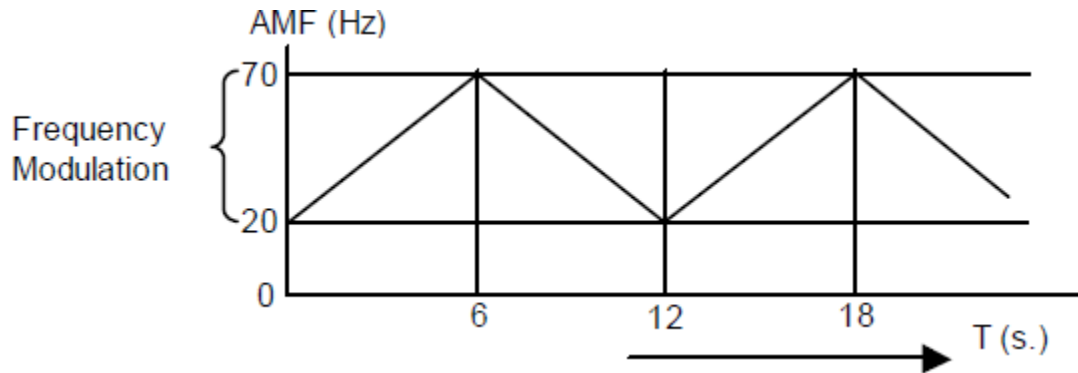


Fig 2.11 Frequency modulation vs Time

Setting a lower AMF.

The preceding is summarized within the following basic rules.

Taking accommodation under consideration, patients with acute conditions area unit treated with:

- A comparatively low amplitude;
- A comparatively high AMF;
- A comparatively broad Frequency Modulation;
- A comparatively gently dynamical modulation program with a protracted length
(6/6 or 1/30/1/30 s')

Taking accommodation under consideration, patients with less acute conditions area unit treated with:

- A comparatively high amplitude;
- A comparatively low AMF;
- A comparatively slim Frequency Modulation;
- A comparatively abrupt modulation program with a brief length (1/1 s).

TENS safe:

Experts typically take into account TENS to be safe, though the machine might cause hurt if abused. Have your healer or doctor show you the right thanks to use the machine, and follow these directions rigorously. invariably tell your doctor if you're mistreatment another medical care or if you're wondering combining another medical care along with your typical medical treatment. it's going to not be safe to forgo your typical medical treatment and bank solely on another medical care.

CHAPTER- 3

SIMULATION THEORY

PROTEUS DESCRIPTION

The Proteus style Suite may be a proprietary computer code tool suite used primarily for electronic style automation. The computer code is employed in the main by electronic style engineers and technicians to form schematics and electronic prints for producing computer circuit boards. The micro-controller simulation in Proteus works by applying either a hex file or a correct file to the microcontroller half on the schematic. it's then co-simulated beside any analog and digital natural philosophy connected thereto. this permits its use in an exceedingly broad spectrum of project prototyping in areas like control, temperature management and programme style. It additionally finds use within the general amateur community and, since no hardware is needed, is convenient to use as a coaching or teaching tool.

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KEIL

Keil development tools for the 8051 Microcontroller design support each level of code developer from the skilled applications engineer to the coed simply learning regarding embedded code development. The industry-standard Keil C Compilers, Macro Assemblers, Debuggers, period of time Kernels, Single-board Computers, and Emulators support all 8051 derivatives and assist you get your comes completed on schedule. Keil could be a German code subsidiary of Arm Holdings. it absolutely was supported in 1982 by Günter and Reinhard Keil, at the start as a German GbR. In Apr 1985 the corporate was regenerate to Keil Elektronik GmbH to plug add-on merchandise for the event tools provided by several of the Si vendors. Keil enforced the primary compiling program designed from the ground-up specifically for the 8051 microcontroller. Keil provides a broad vary of development tools like ANSI compiling program, macro assemblers, debuggers and simulators, linkers, IDE, library managers, period of time in operation systems and analysis boards for Intel 8051, Intel MCS-251, ARM, and families. In Oct 2005, Keil (Keil Elektronik GmbH in Muenchen, Germany, and Keil code, Inc. in Plano, Texas) were noninheritable

SIMULATION CIRCUIT

SIMULATION CIRCUIT OF TENS IN ON POSITION

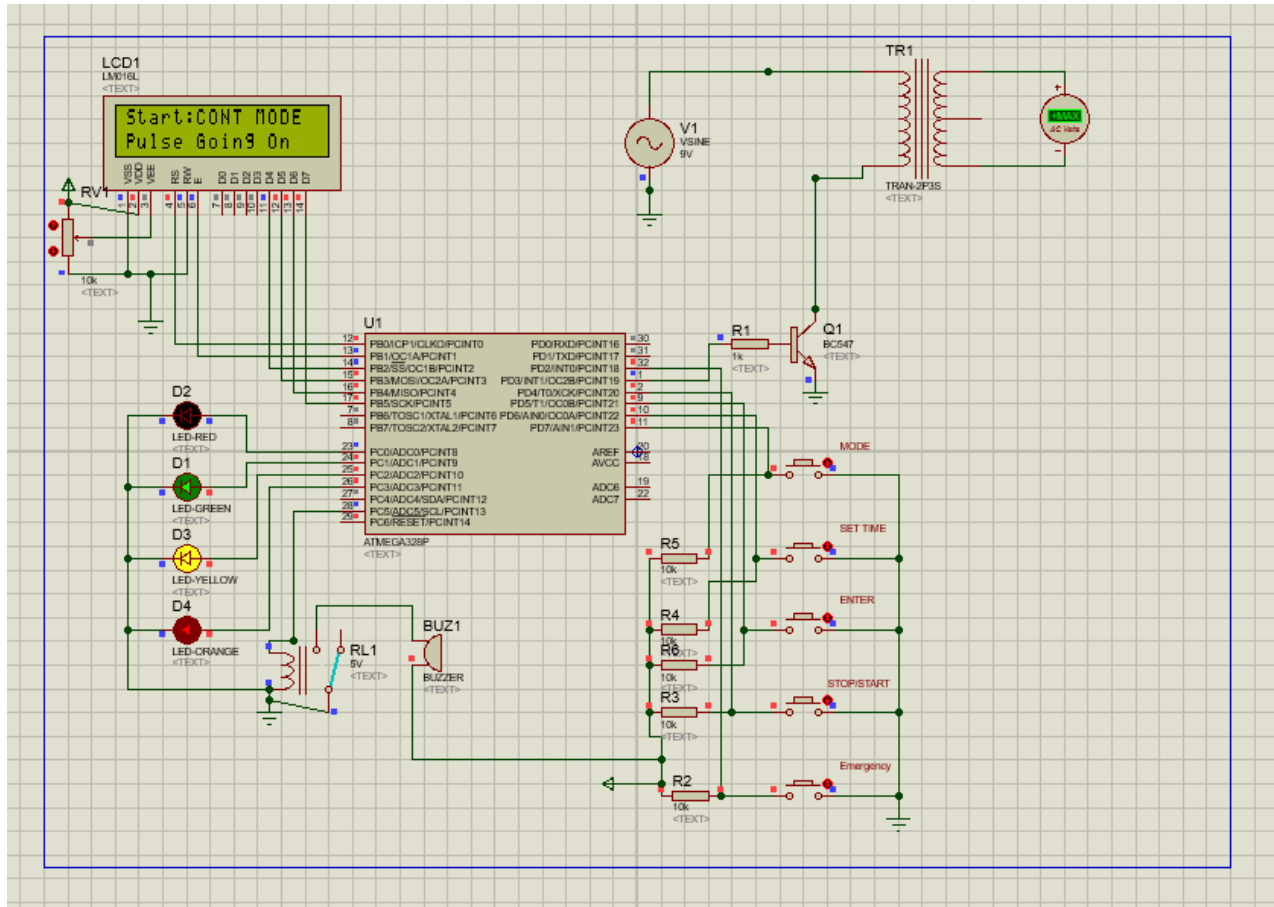


Fig 3.1 Simulation Circuit

The simulation of the project was carried out Proteus and the HEX. File is created using keil.Circuit Diagram for Transcutaneous electrical nerve stimulation(TENS) In ON condition is also shown in fig 3.1 The figures in the subsequent pages show the following output parameters of the simulation setup

SIMULATION CIRCUIT OF TENS IN OFF POSITION

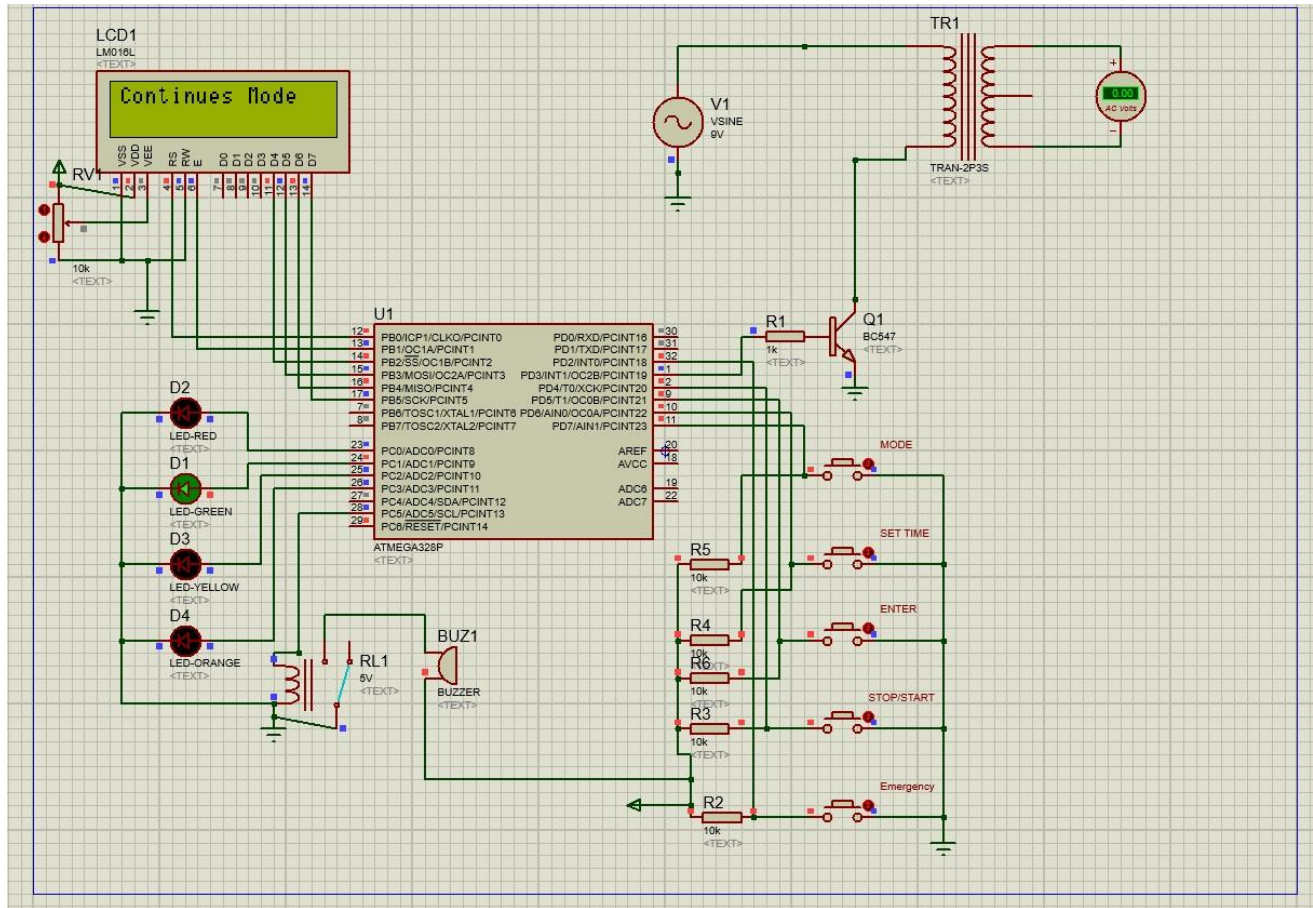


Fig 3.2 Simulation Circuit In OFF Condition

In this simulation the mode is set to continues mode (i.e.) any one mode from four mode of operation based on the user requirement. The device is ready 'ON' but it won't create any electrical pulses until and unless the start key is triggered by the user. And this position is know as 'OFF' position

SIMULATION CIRCUIT OF TENS IN EMERGENCY OFF POSITION

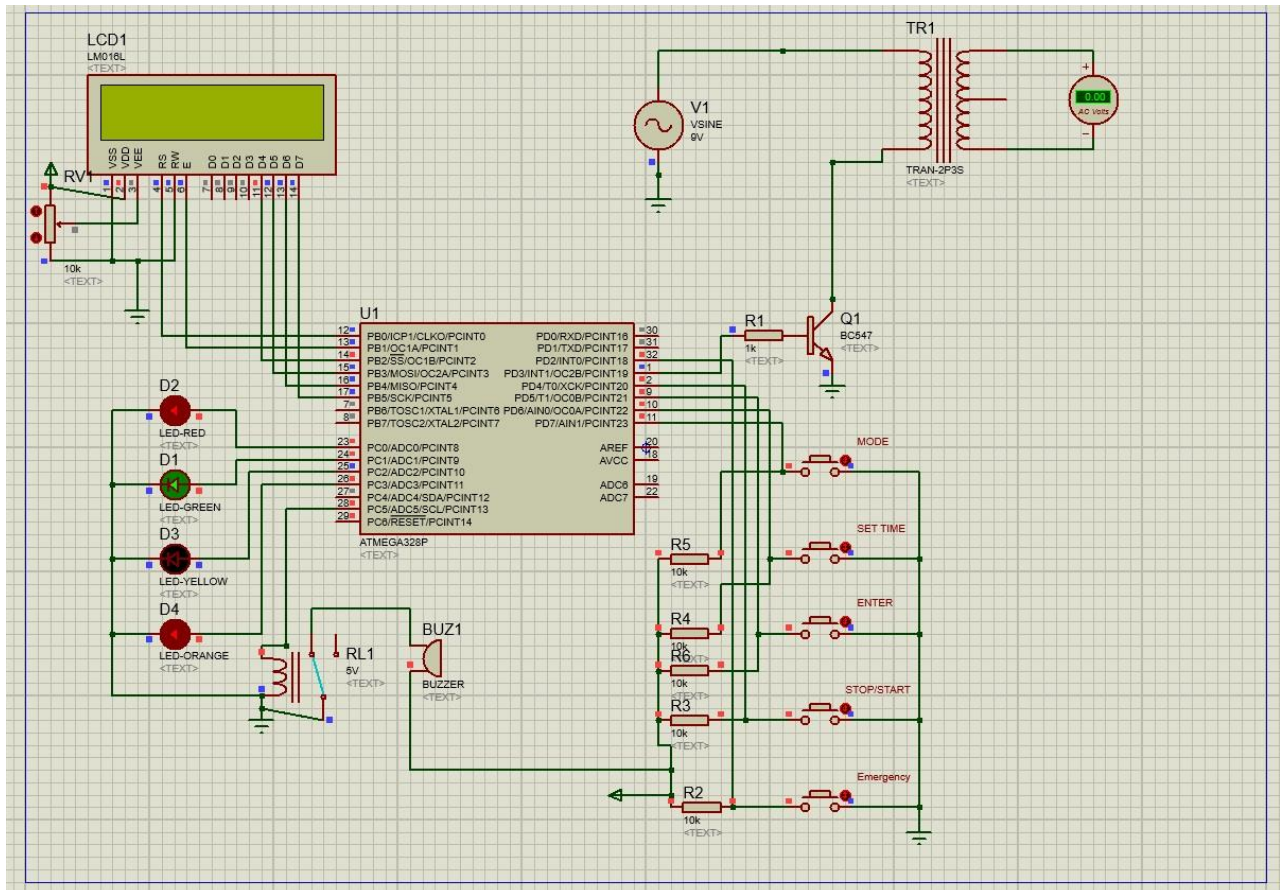


Fig 3.3 Simulation Circuit In Emergency Off Condition

Emergency switch is hit by the user when the user feels uncomfortable, short-circuit or any other circumstance which may lead to harm the human body etc.

CHAPTER-4

HARDWARE DESCRIPTION

Capacitive Sensing

Capacitive sensing is employed in interface applications to make non-contact switches (or sensors). once protected by Associate in Nursing insulating layer, electrical phenomenon sensors give a chic style overlay and supply hardness in severe environments .Very merely, a electrical phenomenon detector may be a combine of adjacent plates (electrodes).

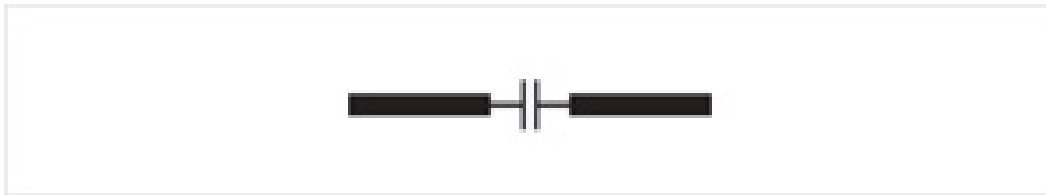


Fig 4.1 capacitive sensor

When a semiconducting object is placed in proximity to those electrodes, there's capacitance between the electrodes and therefore the semiconducting object. The semiconducting object could be a finger within the following case, tho' this system can be applied to any semiconducting object. Examples embody semiconducting door plates or position sensors.



Fig 4.2 Position sensors

The most common variety of capacitance detector array could be a set of capacitors wherever one aspect of every is grounded. The presence of a semiconductive object will increase the capacitance of the switch to ground, and crucial detector activation is merely a matter of measurement modification in capacitance.

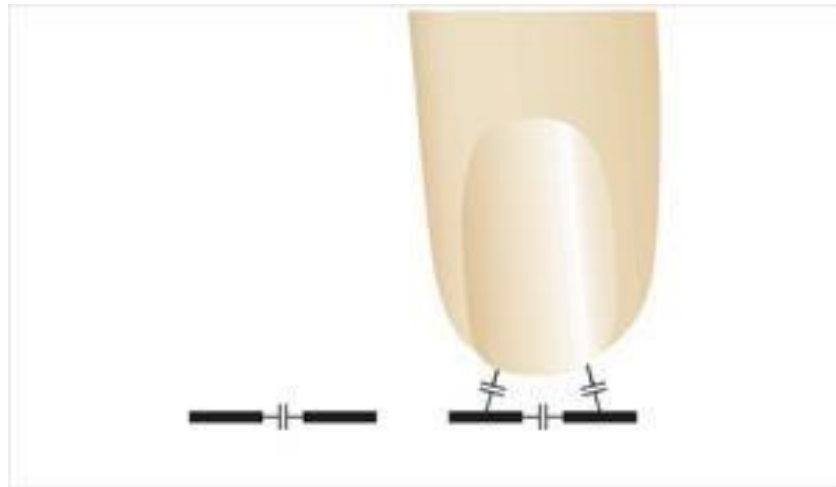


Fig 4.3 Activation sensor

INTRODUCTION ABOUT CONTROLLER(AT89S52)

Description

The AT89S52 may be a low-power, superior CMOS 8-bit microcontroller with 8K bytes of in-system programmable non-volatile storage. The device is factory-made victimization Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set and pinout. The on-chip Flash permits the program memory to be reprogrammed in-system or by a traditional nonvolatile memory engineer. By combining a flexible 8-bit mainframe with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 may be a powerful microcontroller that provides a highly-flexible and cost-efficient answer to several embedded management applications.

The AT89S52 provides the subsequent customary features: 8K bytes of Flash, 256 bytes of RAM, thirty two I/O lines, Watchdog timer, 2 knowledge pointers, 3 16-bit timer/counters, a six-vector two-level interrupt design, a full duplex interface, on-chip generator, and clock electronic equipment. additionally, the AT89S52 is intended with static logic for operation all the way down to zero frequency and supports 2 software package selectable power saving modes. The Idle Mode stops the mainframe whereas permitting the RAM, timer/counters, interface, and interrupt system to continue functioning. The Power-down mode saves the RAM contents however freezes the generator, disabling all different chip functions till subsequent interrupt or hardware reset.

Features:

- Compatible with MCS-51® Products
- 8K Bytes of In-System Programmable (ISP) Flash Memory – Endurance: 1000

Write/Erase Cycles

- 4.0V to 5.5V Operating Range
- Fully Static Operation: 0 Hz to 33 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Full Duplex UART Serial Channel

Low-power Idle and Power-down Modes

- Interrupt Recovery from Power-down Mode
- Watchdog Timer • Dual Data Pointer
- Power-off Flag

PIN DIAGRAM

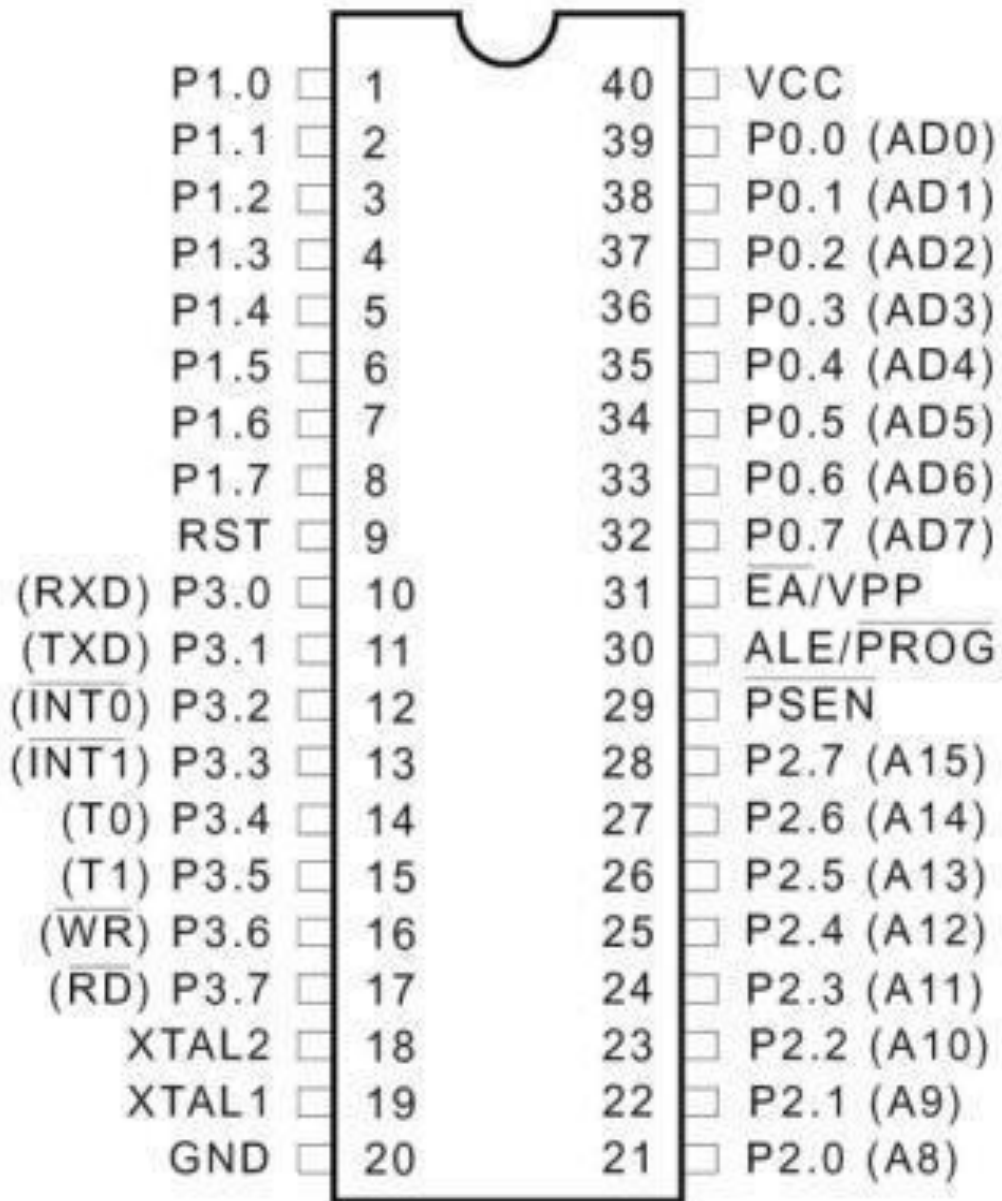


Fig 4.4 Pin diagram

Pin Description

VCC Supply voltage.

GND Ground.

Port 0

Port zero is AN 8-bit open drain bidirectional I/O port. As AN output port, every pin will sink eight TTL inputs. once 1s square measure written to port zero pins, the pins may be used as high-impedance inputs. Port zero can even be designed to be the multiplexed low-order address/data bus throughout accesses to external program and information memory. during this mode, P0 has internal pull-ups. Port zero conjointly receives the code bytes throughout Flash programming and outputs the code bytes throughout program verification. External pull-ups square measure needed throughout program verification.

Port 1

Port one is associate 8-bit bidirectional I/O port with internal pull-ups. The Port one output buffers will sink/source four TTL inputs. once ones area unit written to Port 1 pins, they're force high by the interior pull-ups and might be used as inputs. As inputs, Port one pins that area unit outwardly being force low can supply current (IIL) owing to the interior pull-ups. additionally, P1.0 and P1.1 may be designed to be the timer/counter two external count input (P1.0/T2) and therefore the timer/counter two trigger input (P1.1/T2EX), severally, as shown within the following table. Port one conjointly receives the low-order address bytes throughout Flash programming and verification.

Port 2

Port 2 is associated 8-bit two-way I/O port with internal pull-ups. The Port 2 output buffers can sink/source four TTL inputs. Once 1s are written to Port 2 pins, they are forced high by the internal pull-ups and will be used as inputs. As inputs, Port 2 pins that are externally being forced low will provide current (IIL) owing to the internal pull-ups. Port 2 emits the high-order address store unit throughout fetches from external program memory and through accesses to external info memory that use 16-bit addresses (MOVX @ DPTR). Throughout this application, Port 2 uses strong internal pull-ups once emitting 1s. Throughout accesses to external info memory that use 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register. Port 2 to boot receives the high-order address bits and some management signals throughout Flash programming and verification.

Port 3

Port three is associated degree 8-bit bi-face I/O port with internal pull-ups. The Port three output buffers will sink/source four TTL inputs. Once 1s are square measure written to Port three pins, they're forced high by the internal pull-ups and might be used as inputs. As inputs, Port three pins that square measure outwardly being forced low can supply current (IIL) thanks to the pull-ups. Port three receives some management signals for Flash programming and verification. Port three additionally serves the functions of assorted special options of the AT89S52.

RST Reset input.

A high on this pin for 2 machine cycles whereas the generator is running resets the device. This pin drives high for ninety-eight generator periods when the Watchdog times out. The DISRTO bit in SFR AUXR (address 8EH) is wont to disable this feature. Within the default state of bit DISRTO, the RESET HIGH out feature is enabled.

ALE/PROG

Address Latch modify (ALE) is Associate in Nursing output pulse for latching the low computer memory unit of the address throughout accesses to external memory. This pin is additionally the program pulse input (PROG) throughout Flash programming. In traditional operation, beer is emitted at a relentless rate of 1/6 the generator frequency and will be used for external temporal order or continuance functions. Note, however, that one beer pulse is skipped throughout every access to external knowledge memory. If desired, beer operation is disabled by setting bit zero of SFR location 8EH. With the bit set, beer is active solely throughout a MOVX or MOVC instruction. Otherwise, the pin is frail force high. Setting the ALE-disable bit has no impact if the microcontroller is in external execution mode.

EA/VPP External Access Enable.

EA should be strapped to GND so as to modify the device to fetch code from external program memory locations beginning at 0000H up to FFFFH. Note, however, that if lock bit one is programmed, Semitic deity are internally secured on reset. Semitic deity ought to be strapped to VCC for internal program executions. This pin additionally receives the 12-volt programming modify voltage (VPP) throughout Flash programming.

XTAL1 Input to the inverting generator electronic equipment and input to the interior clock operative circuit.

XTAL2 Output from the inverting generator electronic equipment.

Special Function Registers

A map of the on-chip memory space known as the Special perform Register (SFR) area is shown in Table 5-1. Note that not all of the addresses area unit occupied, and unoccupied addresses might not be enforced on the chip. browse accesses to those addresses can generally come random information, AND write accesses can have an

indeterminate impact. User code mustn't write 1s to those unlisted locations, since they'll be utilized in future merchandise to invoke new options. In this case, the reset or inactive values of the new bits can forever be zero. Timer a pair of Registers: management and standing bits area unit contained in registers T2CON (shown in Table 5- a pair of) and T2MOD (shown in Table 10-2) for Timer 2. The register combine (RCAP2H, RCAP2L) area unit the Capture/Reload registers for Timer a pair of in 16-bit capture mode or 16-bit auto-reload mode. Interrupt Registers: The individual interrupt change bits area unit within the that is register. 2 priorities may be set for every of the six interrupt sources within the information processing register.

LIQUID CRYSTAL DISPLAY (LCD)

INTRODUCTION

A liquid show (LCD) could be a skinny, flat electronic visual display that uses the sunshine modulating properties of liquid crystals (LCs). LCs doesn't emit lightweight directly. they're utilized in a large vary of applications, as well as laptop monitors tv, instrument panels, craft cockpit displays, etc. LCDs have displaced ray tube (CRT) displays in most applications. they're typically additional compact, light-weight, portable, more cost-effective, and additional reliable.

Each component of associate degree LCD usually consists of a layer of molecules aligned between 2 clear electrodes and 2 polarizing filters, the axes of transmission of that area unit (in most of the cases) perpendicular to every alternative. With no actual liquid between the polarizing filters, lightweight passing through the primary filter would be blocked by the second (crossed) polarizer. In most of the cases the liquid has refraction.

The surfaces of the electrodes that square measure in-tuned with the liquid material square measure treated therefore on align the liquid molecules during a explicit direction. Electrodes square measure fabricated from a clear conductor known as metal Tin Oxide(ITO).

PSEN

Program Store change (PSEN) is that the browse strobe light to external program memory. once the AT89S52 is capital punishment code from external program memory, PSEN is activated double every machine cycle, except that 2 PSEN activations square measure skipped throughout every access to external information memory

Before applying an electrical field, the orientation of the liquid molecules is decided by the alignment at the surfaces of electrodes. during a twisted nematic device the surface alignment directions at the 2 electrodes square measure perpendicular to every alternative, and then the molecules organize themselves during a spiral structure, or twist. This reduces the rotation of the polarization of the incident lightweight, and also the device seems gray. If the applied voltage is giant enough, the liquid molecules within the center of the layer square measure virtually utterly straight and also the polarization of the incident lightweight isn't revolved because it passes through the liquid layer. This lightweight can then be primarily polarized perpendicular to the second filter, and therefore be blocked and also the element can seem black. By dominant the voltage applied across the liquid layer in every element, lightweight may be allowed to taste in variable amounts therefore constituting completely different levels of grey.

PIN DESCRIPTION

The most common used LCDs found within the market these days area unit one line, 2 line, or four line LCDs that have only 1 controller and support at the most of eighty characters, whereas LCDs supporting quite eighty characters create use of 2HD44780 controllers. a lot of LCDs with one controller has fourteen pins and LCDs with two controller has 16 pins.

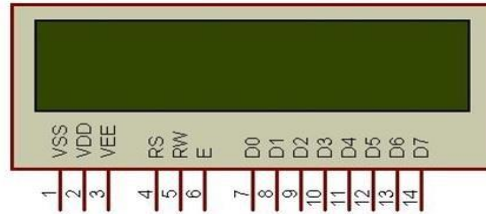


Fig 4.5 Pin diagram of 2x16 LCD

FEATURES

- 5 x eight dots with indicator.
- Built-in controller (KS 0066 or Equivalent)
- + 5V power offer (Also accessible for + 3V)
- 1/16 duty cycle
- B/L to be driven by pin one, pin a pair of or pin fifteen, pin sixteen or A.K (LED)
- N.V. nonobligatory for + 3V power offer.

PIN NO.,	SYMBOL	FUNCTION
1.	Vss	GND
2.	Vdd	+3V or +5V
3.	Vo	Contrast Adjustment
4.	RS	H/L Register Select Signal
5.	R/ $\hat{W}$	H/L Read and Write Signal
6.	E	H→L Enable Signal
7.	DB0	H/L Data Bus Line
8.	DB1	H/L Data Bus Line
9.	DB2	H/L Data Bus Line
8.	DB3	H/L Data Bus Line
11.	DB4	H/L Data Bus Line
12.	DB5	H/L Data Bus Line

13.	DB6	H/L Data Bus Line
14.	DB7	H/L Data Bus Line
15.	A/Vee	+4.2V for LED/Negative Voltage Output
16.	K	Power Supply for B/L (0V)

Table 4.1.Pin details of LCD

DISPLAY CHARACTER ADDRESS CODE

Display Position	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
DD RAM Address	00	01														0F
DD RAM Address	40	41														4F

Fig 4.6 Address code for displaying character

BF- BUSY FLAG

Busy flag is associate degree standing indicator flag for digital display. after we send a command or knowledge to the digital display for process, this flag is ready (BF=1) and as before long because the instruction is dead with success this flag is cleared (BF=0). this is often useful in manufacturing and precise quantity of delay for the digital display process. To scan busy flag, the condition RS=0 and R/W=1 should be met and also the mutual savings bank of the digital display knowledge bus (D7) act as busy flag. once BF =1 means that digital display is busy and can not settle for next command or knowledge and BF=0 means that digital display is prepared for succeeding command or knowledge to method

INSTRUCTION AND DATA REGISTER

There are 2 8-bit registers in HD44780 controller: Instruction and information register. Instruction register corresponds to the register where you send commands to digital display e.g. digital display shift command, LCD clear, digital display address etc. and information register is employed for storing information that is to be displayed on digital display. Once the address signal of the digital display is declared, the pins are connected to the information register and data is then sent mechanically to the DDRAM and thus is displayed on the digital display.

Data register isn't solely used for sending information to DDRAM; however, conjointly for CGRAM, the address where you would like to send the information, is determined by the instruction you send to digital display. We'll discuss a lot of on digital display instruction set any during this chapter.

COMMANDS AND INSTRUCTION SET

Only the instruction register (IR) and therefore the data register (DR) of the liquid crystal display may be controlled by the MCU. Before beginning the interior operation of the liquid crystal display, management info is quickly kept into these registers to permit interfacing with numerous MCUs, that operate at completely different speeds, or numerous peripheral management devices. The interior operation of the liquid crystal display is set by signals sent from the MCU. These signals, that embrace register choice signal (RS), read/write signal (R/W), and therefore the data bus (DB0 to DB7), control the liquid crystal display directions (Table 3).

No.	Instruction	Hex	Decimal
1	Function Set: 8-bit, 1 Line, 5x7 Dots	0x30	48
2	Function Set: 8-bit, 2 Line, 5x7 Dots	0x38	56
3	Function Set: 4-bit, 1 Line, 5x7 Dots	0x20	32
4	Function Set: 4-bit, 2 Line, 5x7 Dots	0x28	40
5	Entry Mode	0x06	6
6	Display off Cursor off (clearing display without clearing DDRAM content)	0x08	8
7	Display on Cursor on	0x0E	14
8	Display on Cursor off	0x0C	12
9	Display on Cursor blinking	0x0F	15
10	Shift entire display left	0x18	24
12	Shift entire display right	0x1C	30
13	Move cursor left by one character	0x10	16
14	Move cursor right by one character	0x14	20
15	Clear Display (also clear DDRAM content)	0x01	1

Table 4.2 Commands And Instruction Set

Commands

There are four classes of instructions that:

- 1) Designate liquid crystal display functions, like show format, knowledge length, etc.
Set internal RAM addresses
- 2) Perform knowledge transfer with internal RAM
- 3) Perform the miscellaneous functions.

Variable pot

POTENTIOMETER

A potentiometer may be a three-terminal resistance with a slippery or rotating contact that forms an adjustable resistor. If only 2 terminals are used, one end and also the wiper, it acts as a resistance or resistor.

A potentiometer may be a manually adjustable, resistance with 3 terminals. 2 terminals are connected to a resistive part, the third terminal is connected to an adjustable wiper. The position of the wiper determines the output voltage.

Variable potentiometers are a unit out there in an exceedingly type of totally different mechanical variations leaving simple adjustment to regulate a voltage, current, or the biasing and gain management of a circuit to get a zero condition.

The name “potentiometer” may be a combination of the words electric potential and Metering, that came from the first days of physics development. It absolutely was thought then that adjusting giant wirewound resistive coils metered or measured out a collection quantity of electric potential creating it a sort of voltage-metering device.



Fig 4.8 Potentiometer

ANALOG TO DIGITAL (ADC 0809)

An digitizer (ADC) may be a wide used electronic part that converts AN analog electrical signal (usually a voltage) into a digital illustration. AN electronic microcircuit that transforms a symptom from analog (continuous) to digital (discrete) kind. Analog signals square measure directly measurable quantities. Digital signals solely have 2 states. For data processor, we have a tendency to talk to binary states, 0 and 1.

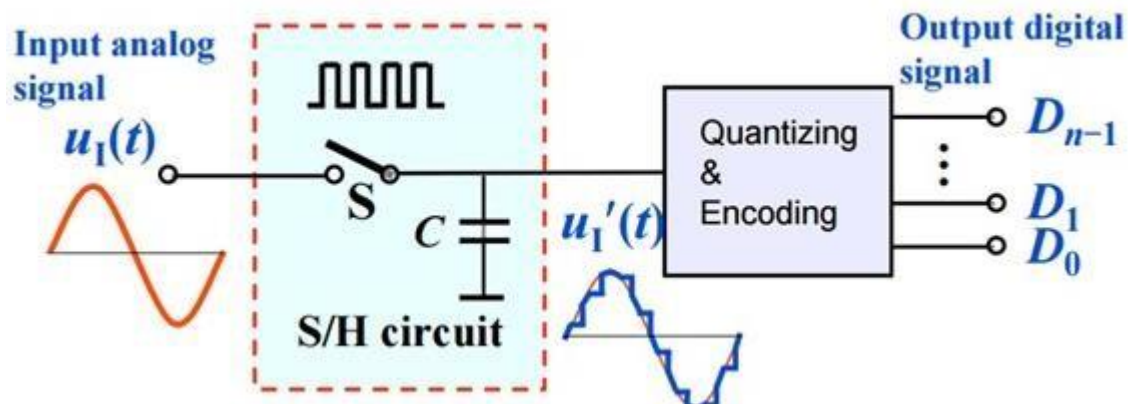


Fig 4.9 Analog To Digital Signal

DIGITAL TO ANALOG (DAC 0808)

A data converter (DAC) may be a device, typically consisting of one chip, for changing binary or digital code into associated analog signal. A DAC device converts associated abstract finite precise variety, generally a fixed-point binary variety, into an exact physical variable like voltage or pressure.

The DAC0808 is associated 8-bit monolithic data converter (DAC) that includes a full scale output current subsiding time of a hundred and fifty ns whereas dissipating solely thirty three mW with $\pm 5V$ provides. No reference current (I_{REF}) trimming is needed for many applications since the total scale output current is often ± 1 LSB of $255 I_{REF}/256$. Relative accuracies of higher than $\pm 0.19\%$ assure 8-bit monotonicity and dimensionality whereas zero level output current of but four μA provides 8-bit zero accuracy for $I_{REF} \geq 2$ mA. the ability offer currents of the DAC0808 is freelance of bit codes, and exhibits primarily constant device characteristics over the whole offer voltage vary

- Features Relative accuracy: $\pm 0.19\%$ error most
- Full scale current match: ± 1 LSB typ
- quick sinking time: one hundred fifty ns typ
- Non inverting digital inputs are TTL and CMOS compatible
- High speed multiplying input slew rate: eight mA/ μs
- Power provide voltage range: $\pm 4.5V$ to $\pm 18V$
- Low power consumption: thirty three mW @ $\pm 5V$

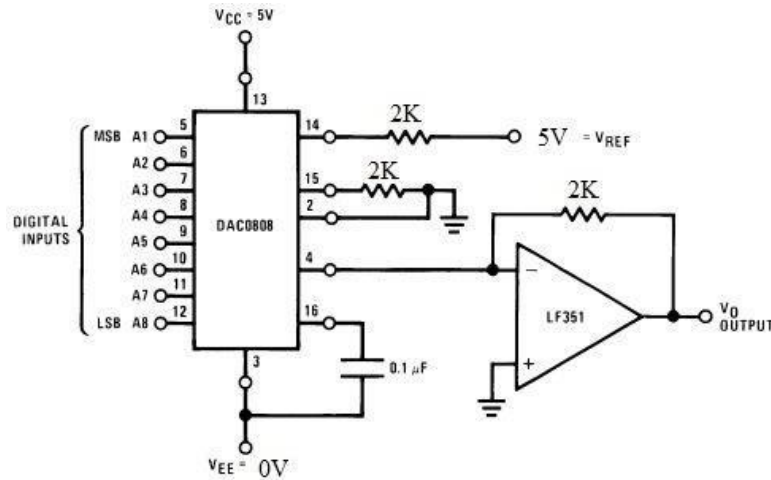


Fig 4.10 Dac Chip

ELECTRODES

Electrodes

Electromyography (EMG) measures muscle response or electrical activity in response to a nerve's stimulation of the muscle. The take a look at is employed to assist find fibre bundle abnormalities. throughout the take a look at, one or a lot of tiny needles (also referred to as electrodes) area unit inserted through the skin into the muscle

These top quality disposable electrodes ar} to be wont to measure encephalogram, EKG and electromyogram. {they area unit|they're} to be used once and are terribly handy thanks to integrated gel. They adhere all right to the skin and area unit clean to use.

EMG electrodes and its varieties. The bioelectrical activity within the muscle of an individual's body is detected with the assistance of electromyogram electrodes. There area unit 2 main forms of electromyogram electrodes: surface (or skin electrodes) and inserted electrodes.

Surface electromyogram assesses muscle perform by recording muscle activity from the surface higher than the muscle on the skin. Surface electrodes area unit able to offer solely a restricted assessment of the muscle activity. Surface electromyogram are often recorded by a combine of electrodes or by a a lot of complicated array of multiple electrodes.



Fig 4.11 Electrodes

CAPSENSE PAD:

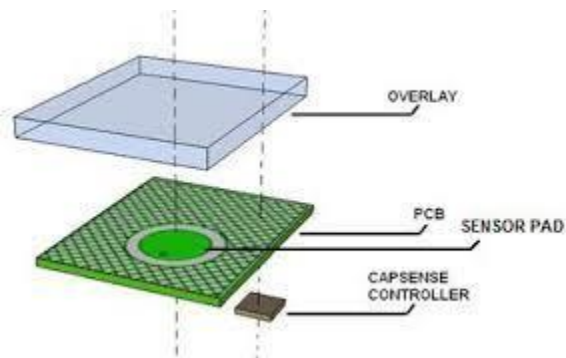


Fig 4.12 Capsense Pad

Capacitive bit sensing has modified the face of commercial style in merchandise like cellphones, PCs, client physics, automotive, and white merchandise. Cypress CapSense solutions bring elegant, reliable, and easy-to-use electrical phenomenon bit sensing practicality to your style. Our electrical phenomenon bit sensing solutions have replaced over four billion mechanical buttons. A CapSense-based programme style has the subsequent blessings over a mechanical-buttons primarily based design. Mechanical buttons square measure less reliable and wear out over time because of the physical

movement. CapSense styles don't involve moving elements. Mechanical buttons create issues once wet seeps through the gaps within the assembly. CapSense-based front panels may be fully sealed beneath the overlay. Mechanical buttons need a little force to control compared to the bit buttons and this force will increase over time because of the buildup of dirt within the gaps. Mechanical buttons need multiple elements AND increase the BOM price whereas several CapSense styles encompass solely a PCB and an overlay with adhesive. Mechanical buttons embrace the value of tools needed to form cutouts within the front panel. Cap Sense styles don't need such cutouts. Mechanical buttons yield poor aesthetics compared to the sleek and stylish bit buttons. CapSense styles conjointly provide additional flexibility in coming up with the programme in terms of button form and graphical illustration. Cypress' strong CapSense solutions leverage our versatile Programmable System-on-Chip (PSoC) design, that accelerates time-to-market, integrates essential system functions, and reduces BOM price. Cypress offers a good variety of configurable and programmable CapSense controllers. Configurable CapSense controllers square measure hardware or I2C configurable. Programmable devices offer complete flexibility to fulfill your precise style necessities, together with reducing BOM price by desegregation additional system practicality. Following square measure a number of the distinctive options offered by CapSense merchandise.

BUZZER:



Fig 4.13 Buzzer

This is tiny PCB Mountable 5V Passive Buzzer. it's nice to feature Audio responsive to your electronic styles. It operates on 5V DC Power provide, uses a coil part to get Associate in Nursing sounding tone.

Specifications:

- Input Voltage(Max.) : 5V
- Resistance: forty two forty two
- Resonance Frequency: 2048 cycle per second
- Body Size : twelve x 8mm
- Pin Pitch: 6mm
- External Material: Plastic
- Color: Black

Package Includes:

- 10 x Passive Buzzer

EMBEDDED C:

Embedded c may be a set of language extension for the C artificial language by the C Standards committee to deal with commonality problems that exist between C extensions for various embedded systems. traditionally embedded C programming needs nonstandard extensions to the C language so as to support exotic options like fixed-point arithmetic, multiple distinct memory banks, and basic I/O operations.

Embedded C uses most of the syntax and linguistics of normal C, e.g., main() operate, variable definition, knowledge sort declaration, conditional statements(if, switch, case),loops(while, for),functions, arrays and strings, structures and union, bit operations, macros, etc. throughout infancy years of silicon chip based mostly systems, programs were developed victimization assemblers and consolidated into the EPROMs. There wont to be no mechanism to seek out what the program was doing. LEDs, switches, etc. were wont to check for proper execution of the program .But they were too expensive and weren't quite reliable furthermore .As time progressed, use of microprocessor-specific assembly-only because the artificial language reduced and embedded systems captive onto C because the embedded artificial language of alternative. C is that the most generally used artificial language for embedded processors/controllers.

HARD WARE KIT



This model works under four modes of operation (ie) Continuous Modes ,Burst Modes, Random Modes, Frequency Modes. A timer switch is used to enhance the user to fix the required time period. Start and stop switch is used to start the mode of operation and to stop it. An emergency switch has been used here to stop the machine at certain situation

CHAPTER 5

CONCLUSION

CONCLUSION:

We proposed capacitive sense based tens- tiny electronic shock machine for patient transcutaneous electrical nerve stimulator. These simple mechatronics device may be all that is needed to offer different types of exercise required for a patient. It can be used as new compliant but powerful light weight actuators, which are useful for both stroke therapy and impairment quantification.

Here we have a tendency to area unit within the last a {part of} our report and it's regarding the conclusion part of the project. THE body covering electrical nerve stimulation involves to cure the pain with the assistance of low voltage current. a small device delivers that produces current close to nerves. Trascutaneous Electrical Nerve Stimulator medical care recovers your perception of pain. From the prevailing system we have a tendency to had created and are available up with within the exisitng system we have a tendency to don't have modes of operation in it. But in our projected system we have a tendency to used four completely different modes of operation in it. So by the kind of pain we are able to use the sure modes of operation. By examination the prevailing system we have a tendency to had reduced the dimensions within the projected system. it will be used as pocket friendly and straightforward to hold among all the places. The cost of the projected system is additionally cheaper than by compared to the prevailing system. Apart from this in future we are able to even be modify the projected system by victimization IOT technology we are able to upgrade the system. Our final aim is to reduced the pain with the low current shock therein we have a tendency to had created varied modes of operation in it. TENS mustn't be employed in to the areas of tissue that has recently treated with the radiation and it mustn't used over eyes or mouth, neck or on the top. Mainly it mustn't be used near fruitful organs. TENS at the start of active part of the labour

produces a major decrease in pain and postpones the necessity for medical specialty physiological state with no injurious maternal and perinatal effects. Therefore, it will be thought of an alternate and helpful methodology for labour physiological state.

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