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## REVIEW ON EPIDURAL SPACE LOCATOR WITH MEDICINE INJECTOR

Kavyasree b<sup>1</sup>, Puviarasi<sup>2</sup>

Department of Electronics and Communication Engineering, Saveetha School of Engineering  
Saveetha University, Thandalam, Chennai.

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### Abstract:

Generally, the vertebral section of a human body comprises of Spinal Cord, Caudal Equine, Cervical spine, Thoracic Spine, Lumbar Spine, Epidural Space, and Dura. In this model, the fundamental range concentrated is the Epidural space. It comprises of negative weight from Cervical to Lumbar Spine. Amid surgeries, anesthesia is given around there so that there will be no torment. In the event that the specialist embeds the syringe in the wrong way, takes out the syringe and embeds over and over until it achieves the Epidural Space. Moreover, if the needle touches the Dura, it might even prompt coma of the patients. To maintain a strategic distance from the dangers said in the infusing the anesthesia in epidural Space. The ultrasonic and accelerometer finds the way to low weight and infuses the anesthesia in the Epidural Space.

**Keywords:** Epidural Space, Anesthesia, Ultrasonic, Accelerometer, Caudal Equine, Cervical Spine, Thoracic Spine, Lumbar Spine, Dura.

### I. Introduction

Space was initially depicted by Corning in numerous papers were distributed for infusing pharmaceutical in Spinal Cord. [1]

In Detection of intravascular infusion of an analgesic technique, an anesthesia catheter embedded into the Epidural Space of the patient, infused with a blood solvent color blended nearby sedative through the catheter. A transducer cut positions on the finger for checking the light responsive attributes of the patient's blood. A transducer signal fed to a chip for creating constant presentation for showing to the anesthesiologist that the color, and in this manner the neighborhood analgesic, is available in the circulatory system.

In Electronic epidural marker is a gadget utilized for finding the epidural space for infusing prescription into that space e.g. analgesics. The gadget framed of a noteworthy unit and an extra unit in which the significant unit

comprises of an alert ON and OFF catch, weight switch valve and 1.5-volt battery. At the point when the gadget detects low weight, the alert gets ON and advises the Epidural space.

The present innovation gives programmed syringes held one hand in a pencil-hold in which the fingers (thumb or pointer) work a forwardly based valve that alongside choice of needle breadth and length, control the entrance or departure of liquid from the programmed syringe. These finger-controlled one-gave programmed syringes utilizes picture coordinated strategies, for example, ultrasound - coordinated methods in which the ultrasound test is controlled with one hand and the programmed syringe with the other.

Novel cut needle for epidural anesthesia-utility model identifies with a novel cut needle for epidural anesthesia, having a place with the field of restorative instruments and comprising of a needle handle 1, a needle pole 2, a needle tip 3 and a needle center 4. The novel cut needle for Epidural anesthesia is portrayed in that a localizer 5 is orchestrated on the needle pole 2 utilized for altering the insertion position and profundity of the cut needle. The end of the needle tip 3 is a circular segment formed visually impaired end, which can abstain from harming spinal string and fringe tissues, and a majority of side gaps orchestrated as an afterthought face of the needle tip 3.

An Ultrasonic situating technique for continuous motivation behind measuring the separation between the epidural needle and the Epidural Space is considered. The Ultrasonic situating technique at any rate incorporates a Puncturing step, an Advancing stride, a Positioning stride for synchronous recognizing reflected ultrasonic signs from the Ligamentum Flavum (LF) and Dura Mater (DM). A Replacement venture for expelling the ultrasound needle transducer and presenting an infusing catheter and an Injection venture for infusing a soporific into the epidural space through the infusing catheter is required.

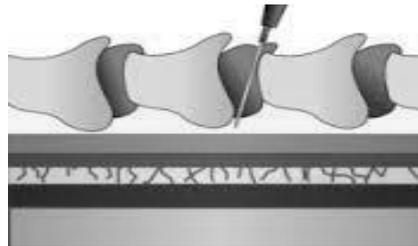
As indicated by the Fixing gadget for anesthesia injector specialized plan, this altering gadget contains a base and portrayed by three supporting legs organized at the lower end of the base, and suction mugs orchestrated on the supporting legs separately. A vertically through flexible sleeve orchestrated at the upper end of the base, the two closures of the versatile sleeve on the base furnished with an adaptive arm.

Injecting anesthesia in the Epidural Space automatically is the purpose of the proposed system. In human anatomy, the five Vertebrae in the Lumbar region part of the Vertebral Column is the area considered. The model consists of four lumbar bones with a low-pressure plastic tube. Ultrasonic Sensor detects the path to the low-pressure area by transmission and reception of the ultrasonic signals. The Linear Actuator model moves the syringe in forward

direction along the path. When injection enters the low-pressure area, slight vibration will occur. Accelerometer detects this sudden vibration changes in the plastic tube.

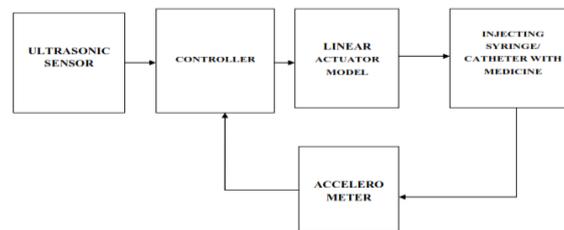
## II. Auto Epidural Space Locator with Medicine Injector System

In the Vertebral Column Model, the stand fixed in position sends ultrasonic waves. Ultrasonic transmitter transmits ultrasonic waves and when it strikes the bone, it reflects. In the presence of tissues and the Epidural space, the ultrasound penetrates indicating that there are no bones in the path of the injection. The injection moves inside slowly using Linear Actuator model along that path.



**Fig 1: Epidural Space withInjector.**

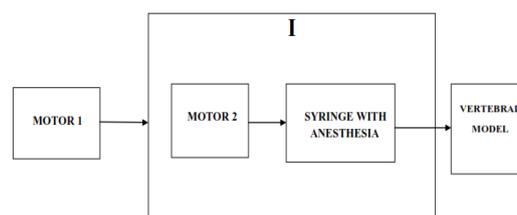
Accelerometer detects the vibration of the syringe when it enters the low-pressure area. When it detects, the linear motion stops and medicine injects in the Epidural space as shown in fig 1.1 epidural space with injector.



**Fig 2: Auto Epidural Space Locator with Medicine Injector System.**

## III. Linearactuator System

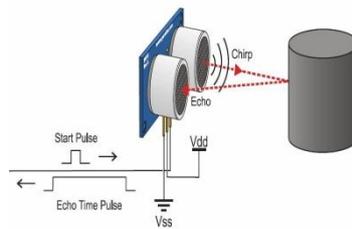
The Linear Actuator framework comprises of motor 1, motor 2 and syringe. Motor 1 is utilized to move the block 1 comprising of motor 2 and syringe. By getting data from the ultrasonic sensor, motor 1 is ON and the infusion advances. At the point when the accelerometer distinguishes required low-weight range, motor 1 move to OFF state and motor 2 is ON so that the syringe infuses the solution in the vertebral model.



**Fig 3: Linear Actuator System.**

#### IV. Hardware Module Description

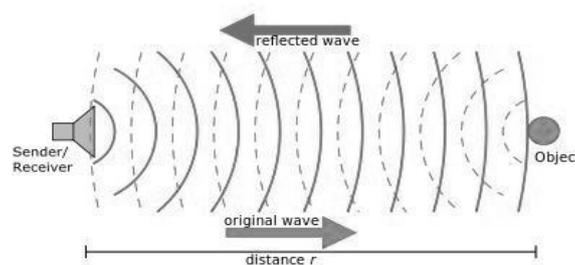
Ultrasonic transducers are transducers that convert ultrasonic waves to electrical waves or vice versa. Those that transmit and receive are called ultrasonic transceivers; many ultrasound sensors besides being sensors are indeed transceivers because they can both sense and transmit. These devices work on a principle similar to that of transducers used in RADAR and SONAR systems, which evaluate attributes of a target by interpreting the echoes from radio or sound waves



**Fig 4: Ultrasonic Operation.**

The timing diagram of HC-SR04 is shown. To start measurement, trig of SR04 must receive a pulse of high (5V) for at least 10 $\mu$ s, this will initiate the sensor will transmit out 8 cycle of ultrasonic burst at 40 KHz and wait for the reflected ultrasonic burst. When the sensor detects ultrasound from receiver it will set the echo pin to high (5V) and delay for a period (width) which proportion to distance. To obtain the distance, measure the width (ton) of echo pin. Ultrasonicsensors are also known as transceivers as above figure 4: ultrasonic operation.

A short ultrasonic pulse transmits at the time 0, reflected by an object. The sensor receives this signal and converts it to an electric signal. The next pulse transmitted when the echo is faded away in a particular amount of time. This period is called cycle period. The recommend cycle period should be no less than 50ms. If a 10 $\mu$ s width trigger pulse sent to the signal pin, the Ultrasonic module will output 40 kHz ultrasonic signal and detects the echo back. The measured distance is proportional to the echo pulse width and calculated. If there is no obstacle, the output pin will give a 38ms high-level signal.



**Fig 5: Transmission and Reception of Ultrasonic Waves.**

Restorative ultrasonic transducers (tests) arrive in an assortment of various shapes and sizes for use in making pictures of various parts of the body. The transducer disregards the surface of the body or embedded into a body

opening, for example, the rectum or vagina. Clinicians who perform Ultrasound-guided methodology regularly utilize a test situating framework to hold the Ultrasonic transducer.

Air location sensors have applications in different parts. On intrusive air, recognition abilities are the most basic applications where the wellbeing of a patient is obligatory. A number of the variables, which can influence execution of sufficiency or constant wave, based detecting frameworks, dispensed with or significantly lessened, along these lines yielding precise and repeatable recognition. The rule behind the innovation is that the transmit signal comprises of short blasts of Ultrasonic vitality. After every burst, the hardware searches for an arrival signal inside a little window of time comparing to the time it takes for the vitality to go through the vessel. Just flags got amid this period will fit the bill for extra flag handling.

An accelerometer is a gadget that measures legitimate speeding up ("g-power"). Legitimate quickening is not the same as direction increasing speed (rate of progress of speed). Accelerometers have various applications in industry and science. Accelerometer distinguishes and screens vibration in turning apparatus. They have applications in tablet PCs and advanced cameras so that pictures on screens dependably showed upright. Accelerometers utilized as a part of automatons for flight adjustment are regular. Sets of accelerometers reached out over a district of space can be utilized to distinguish contrasts (inclinations) in the best possible increasing velocities of edges of references connected with those focuses. These gadgets alluded as gravity gradiometers.

Such pairs of accelerometer in theory may also be able to recognize gravitational waves. Single-and multi-hub models of accelerometer are accessible to recognize size and course of the best possible quickening as a vector amount, and faculties introduction of direction speeding up inasmuch as it produces g-power or an adjustment in vibration, stun, and falling in a resistive medium. Since it begins at zero, then Micro machined accelerometers are progressively present in convenient electronic gadgets and computer game controllers, to identify the position of the gadget or accommodate amusement information.

An accelerometer measures legitimate increasing speed, which is the quickening it encounters with respect to free-fall and is the quickening felt by individuals and items. Accelerometer measures vehicle quickening. They take into consideration assessment of general vehicle execution and reaction. This data modifies different vehicle subsystems as required. Accelerometer measures vibration on autos, machines, structures, process control frameworks and wellbeing establishments. They measure seismic movement, slant, machine vibration, dynamic separation and velocity with or without the impact of gravity. Accelerometers that measure gravity, wherein an accelerometer

particularly arranged for use in gravimeter, called as gravimeters. The ADXL335 utilizes a solitary structure for detecting the three tomahawks. In this manner, the tomahawks sense heading in orthogonal and has minimal cross-pivot affectability. Mechanical misalignment is the essential wellspring of cross-hub affectability. The estimation of quickening or one of its subsidiary properties, for example, vibration, stun, or tilt has turned out to be exceptionally typical in an extensive variety of items. The innovation behind specific accelerometers has progressed to such an extent, to the point that numerous are presently exceptionally financially savvy and easy to use for the customer market (joysticks, running shoes, and so forth).

Creative configuration systems ensure that superior is accomplished the or this reason, there is no sanitation mistake or no monotonic conduct, and temperature hysteresis is low generally not as much as mg over the - to 0 C (temperature range).

A Linear Actuator is an actuator that makes movement in a straight line, rather than the roundabout movement of a traditional electric engine. Straight Actuators utilized as a part of machine apparatuses and mechanical hardware, in PC peripherals, for example, plate drives and printers, in valves and dampers, and in numerous different spots where direct movement is required. Numerous different systems produce direct movement from a turning engine. Mechanical straight actuators commonly work by change of rotational movement into direct movement.

Change usually made through a couple of basic sorts of component: Some mechanical straight actuators just draw, for example, lifts, chain drive and belt drives. Others just push, (for example, a cam actuator). Pneumatic and water driven chambers or lead sinks intended to produce power both bearings.

Mechanical actuators ordinarily change over revolving movement of a control handle or handle into straight removal by means of screws and/or apparatuses to which the handle or handle is appended. A jackscrew or auto jack is a natural mechanical actuator. Another group of actuators taking into account the portions. Pivot of the jack handle is changed over mechanically into the direct movement of the jack head. Mechanical actuators are additionally as often as possible utilized as a part of the field of lasers and optics to control the position of direct stages, revolving stages, mirror mounts, goniometric stand other situating instruments.

For exact and repeatable situating, file marks utilized on control handles. A few actuators incorporate an encoder and computerized position readout. These are like the modification handles utilized on micrometers aside from their motivation is position alteration instead of position estimation. In the dominant part of straight actuator outlines, the essential rule of operation is that of a slanted plane. The strings of a lead screw go about as a ceaseless incline that

permits a little rotational power utilized over a long separation to fulfill development of a vast burden over a short separation.

As a rule when utilizing an electro-mechanical actuator, it is wanted to have some kind of velocity control. Such controllers shift the voltage supplied to the engine, which thusly changes the velocity at which the lead screw turns. In this proposed model, Linear Actuator moves the infusion as shown below fig 2.5: linear actuators. Utilizing Linear Actuator standard with DC engine set up masterminded. Engine driver IC used to control the supply of two engines. In view of system, infusion and entire set up moves as shown in the below fig:6 linear actuators.



**Fig6: Linear Actuators.**

A direct engine is practically the same as a revolving electric engine with the rotor and stator roundabout attractive field parts laid out in a straight line. Where a revolving engine would turn around and re-utilize the same attractive post confronts once more, the attractive field structures of a direct engine physically rehashed over the length of the actuator. Since the engine moves in a straight mold, no lead screw expected to change over rotating movement to direct. While high limit is conceivable, the material and/or engine impediments on most outlines are surpassed generally rapidly because of a dependence exclusively on attractive fascination and aversion strengths.

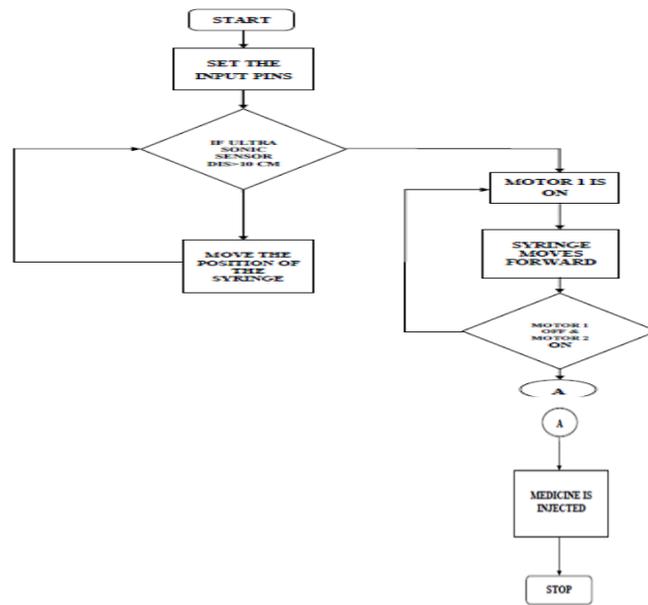
Most straight engines have a low load limit contrasted with different sorts of Linear Actuators. Straight engines have favorable position in outside or filthy situations in that the two parts don't have to get in touch with each other, thus the electromagnetic drive curls waterproofed and fixed against dampness and erosion, taking into account a long administration life. An immediate current engine or DC engine changes over electrical vitality into mechanical vitality. It is one of two fundamental sorts of engines: the other sort is the rotating current or AC engine. Among DC engines, there are shunt – wound, arrangement – wound, compound – wound and perpetual magnet engines. A DC engine is mechanically commutated electric engine fueled from direct present (DC). The stator is stationary in space by definition and hence so is its current. A natively constructed straight power supply (utilized here to power armature radio hardware). An AC controlled unregulated force supply as a rule uses a transformer to change over the voltage from the divider outlet (mains) to an alternate, these days generally lower, voltage. On the off chance that it produces DC, a rectifier changes over rotating voltage to a throbbing direct voltage, trailed by a channel, involving

one or more capacitors, resistors and once in a while inductor, to sift through (smooth) the vast majority of the throb.

A little staying undesirable exchanging voltage segment twice mains power recurrence (contingent on whether half-or-full-wave amendment is utilized) swells unavoidably superimposes on the immediate yield voltage.

**V. Software Implementation**

Linear actuator model consists of two motors such as motor 1 and motor 2 and a syringe set up. Using motor driver IC, the program is coded in Arduino platform. First, motor 1 is moved straight in forward direction to low pressure area. If the syringe enters into low-pressure area, motor1 is stopped and motor 2 is ON. The motor 2 pushes the syringe knob in forward direction thereby injecting anesthesia in the required area.



**Fig:7 Flowchart.**

**Algorithm:**

STEP 1: Start the program.

STEP 2: Set the input pins for ultrasonic sensor.

STEP 3: If the distance is greater than 10cm, motor 1 is ON.

STEP 4: Else repeat step 3 by placing ultrasonic in other position.

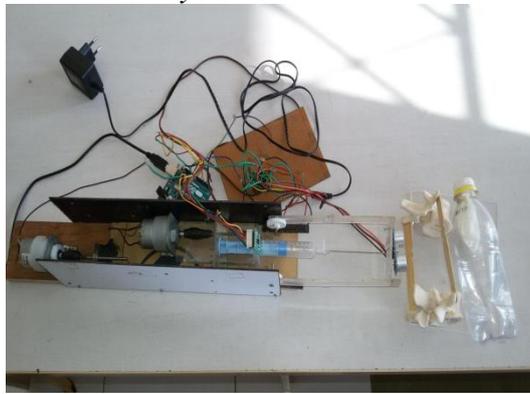
STEP 5: If accelerometer difference is greaterthan 6, motor 1 is OFF & motor isON.

STEP 6: Else, if it is less than 6, motor 1 is continued.

STEP 7: Stop the program

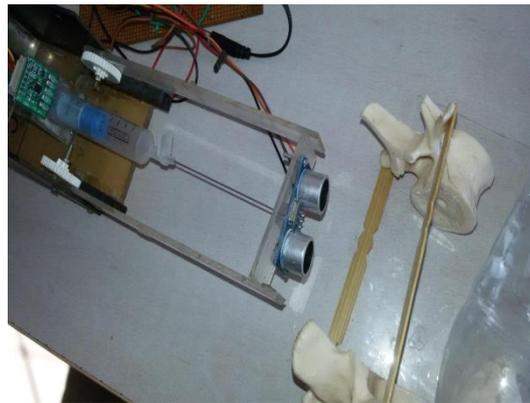
**VI. Results & Discussions**

Fig 8 describes about auto epidural injection module.

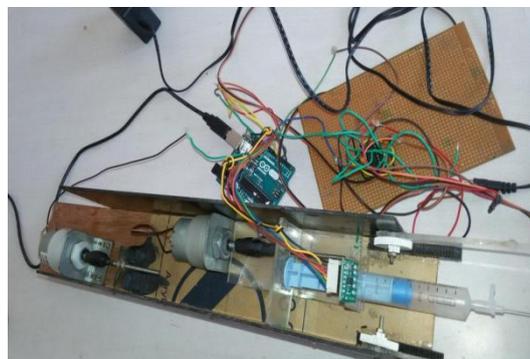


**FIG:8 Auto Epidural Injection Module.**

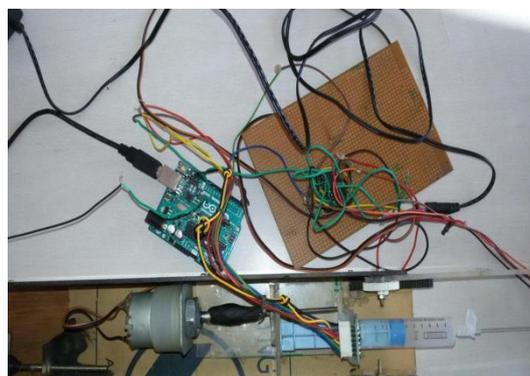
Fig 9 describes about ultrasonic detection and Fig10 explains about accelerometer detection.



**Fig:9: Ultra sonic detection.**



**Fig 10: Accelerometer detection.**



**Fig:11: Linear motion of injection.**

Figure 11 shows linear motion of injection

## VII. Conclusion

Auto Epidural Space Detector with Medicine Injector utilizing Embedded Control focuses to conquer the downsides of the present practices in the therapeutic field. In actuality, the composed framework is for a counterfeit model and still not tried for individual. Be that as it may, this idea and thought will work out and will give a significant methodology amid surgeries. It can likewise be valuable for different applications in the medical field. Implanted frameworks are all around. However, a large portion of these frameworks are islands during a time where more frameworks are being observed utilizing signal handling.

The detecting part in the proposed model should be possible by sign handling for more exactness in finding the way to the epidural space. Weight sensor could be set in the syringe with MEMS innovation, which is utilized to recognize the negativeweight in the Epidural space minutely. The entire setup could be made with PVC plastic or with some light weighted material so that the patient won't feel torment when it is set in his/her body.

## References

1. Suffridge PJ, Wiggins MN, Landes RD, et al; Diphenhydramine as a topical ocular anesthetic. *Can J Ophthalmol.* 2009 Apr; 44(2):181-4.
2. Thefreedictionary.com > local anesthesia In turn citing: Mosby's Medical Dictionary, 8th edition. Copyright 2009
3. "Nerve damage associated with peripheral nerve block". Risks associated with your anesthetic, (The Royal College of Anesthetists). Section 12. January 2006. Retrieved 2007-10-10.
4. Dubinsky RM, Miyasaki J (January 2010). "Assessment: efficacy of transcutaneous electric nerve stimulation in the treatment of pain in neurologic disorders (an evidence-based review): report of the Therapeutics and Technology Assessment Subcommittee of the American Academy of Neurology". *Neurology* 74 (2): 173–6.
5. Sclater, N., *Mechanisms and Mechanical Devices Source book*, 4th Edition (2007), 25, McGraw-Hill
6. Penrose, Roger (2005) [2004]. "17.4 The Principle of Equivalence". *The Road to Reality*. New York: Knopf. pp. 393– 394. ISBN 0-470-08578-9.
7. Doscher, James. "Accelerometer Design and Applications". *Analog Devices*. Archived from the original on 13 December 2008. Retrieved 2008-12-23.