NEAR EAST UNIVERSITY

FACULTY OF ENGINEERING

DEPARTMENT OF BIOMEDICAL ENGINEERING

DESIGN OF A BIOSENSOR DESIGN FOR BRAIN TRAUMA

GRADUATION PROJECT

BME 402

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ABSTRACT

The aim this project is to keep awake people who has had serious accidents and injuries and should be kept under control with the help of a simple sensor circuit. Patients who had a serious head trauma, Cerebral disorders, or similar illnesses and who are under coma risk stay under control for 24-36 hours. Some of these patients should not sleep because their seizure risk continues. If the patient sleeps and goes under deep coma in his/her sleep, it is impossible to understand it and the patient will die because of this seizure.

I designed a device to prevent these serious of events. First of all, a sensor was made by hand. The sensor made up of a metal ball and a copper wire was put in an isolated tube. Second, potentiometry circuit and buzzer added to this circuit forms the alarm unit of the device and they are connected to the sensor. This design will be placed to the head of the patient with a flexible bandage. If the patient wants to sleep and lie down, the device will alarm with a high volume and prevent the patient from sleeping.

According to the market research, there is no such a device in medical sector. There is just a car firm hadöa technology in order to control the drivers and warn them when they slip on the road. Our aim is to improve the device and add modifications in the next step.

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INTRODUCTION

Brain can suffer extensive damage because of a bang on head. There will be hypokinesia, increasing prostration and state of sleeping. The blood flowing from the vein will fill the skul, and cause hematom. In this case, the patient will fall into a deep coma. If the patient sleeps, the coma can not be understood and the patient will pass away. First 24 hour is very essential and the doctor should keep the patient under the observation .

1.1 DISEASES

1.2 What is Traumatic Brain Injury ?

Atraumatic brain injury (TBI), sudden and severe form of an object hitting the head (car windows, heating, concrete, etc.) or the skull of an object piercing damage to brain tissue (such as lead, nails) caused by brain are injuries.

Figure 1 (head trauma)

TBI is a major cause of death and disability worldwide, especially in children and young adults.Males sustain traumatic brain injuries more frequently than do females , However, when matched for severity of injury, women appear to fare more poorly than men.TBI is present in 85% of traumatically injured children, either alone or with other injuries.The greatest number of TBIs occur in people aged 15–24 Because TBI is more common in young people, its costs to society are high due to the loss of productive years to death and disability.The highest rates of death and hospitalization due to TBI are in people over age 65. The incidence of fall-related TBI in First World countries is increasing as thepopulation ages; thus the median age of people with head injuries has increased.

1.3 What are the types of Traumatic Brain Injury?

The form of open and closed head injuries can be divided according to the condition of the skull. Fracture does not occur in closed trauma formed skull fracture in open head injury.

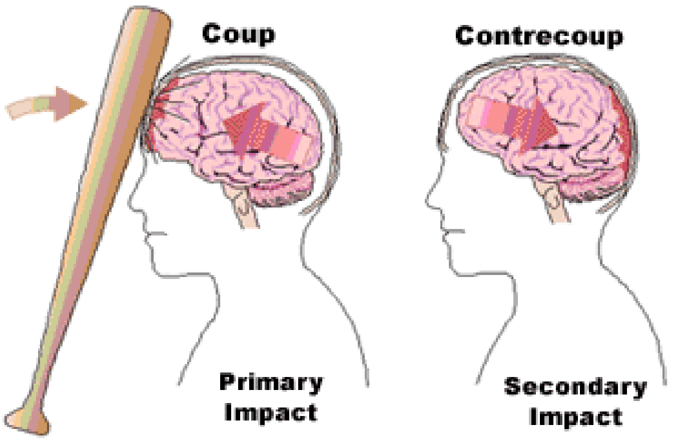


Figure 2 (impact)

1.3.1 Closed Head Injury

- Resulting from falls, motor vehicle crashes,… etc.
- Focal damage and diffuse damage to axons
- Effects tend to be broad (diffuse)
- No penetration to the skull

1.3.2 Open Head Injury

- Results from bullet wounds, etc.
- Largely focal damage
- Penetration of the skull
- Effects can be just as serious

1.3.1.1 Closed-head injuries

Are a type of traumatic brain injury in which the skull and dura mater remain intact.Closed-head injuries are the leading cause of death in children under 4 years old and the most common cause of physical disability and cognitive impairment in young people.Account for about 75% of the estimated 17 million brain injuries that occur annually in the United States. Brain injuries such as closed-head injuries may result in lifelong physical, cognitive, or psychological impairment and, thus, are of utmost concern with regards to public health.

1.3.1.2 Causes of Closed-head injuries

Are caused primarily by vehicular accidents, falls, acts of violence, and sports injuries.Falls account for 35.2% of brain injuries in the United States, with rates highest for children ages 0–4 years and adults ages 75 years and older.Boys aged 0–4 years have the highest rates of brain injury related hospital visits, hospitalizations, and deaths combined. Multiple mild traumatic brain injuries sustained over a short period of time (hours to weeks), often seen with sports-related injuries, can result in major neurological or cognitive deficits or fatality.Closed-head injuries can range from mild injuries to debilitating traumatic brain injuries and can lead to severe brain damage or death.

1.3.1.3Closed-head injuries can range;

From mild injuries to debilitating traumatic brain injuries and can lead to severe brain damage or death.

Common closed-head injuries include:

- Concussion – a head injury resulting in temporary dysfunction of normal brain function. Almost half of the total concussions reported each year are sports-related .

- Intracranial hematoma – a condition in which a blood vessel ruptures causing a pool of blood to form around the brain (subdural hematoma) or between the brain and the skull (epidural hematoma). Intracranial hematoma causes an increase in pressure on the brain and requires immediate medical attention.
- Cerebral contusion – a bruise to the brain tissue as a result of trauma.
- Diffuse axonal injury – an injury to the axon of the neuron. These injuries are frequently seen in car accidents and cause permanent damage to the brain. Severe diffuse axonal injuries often lead to comas or vegetative states.

1.3.2Opened head injuries :

Open head injury refers to a trauma to the head where the skull gets punctured.They can occur in car crashes, sports accidents, workplace accidents, or gunshot or knife wounds that create a skull fracture.If the object exits in a different location than where it entered, as in a gunshot wound, it’s known as a perforating open head injury.An open head wound would create a more serious brain injury than a closed head wound. Because there is an open wound, open head injury victims may suffer from infection and contamination.

1.4 Skull Fractures

Open head injuries differ depending on the type of skull fracture, of which there are four:

1.4.1 Linear Skull Fracture

Linear skull fracture, or a crack in the skull, accounts for about 69 percent of all open head injuries. Because the injury does not penetrate brain tissue, most linear skull fractures are minor and require little treatment.

Nonetheless, it is important to seek immediate medical attention after any traumatic brain injury, including a linear skull fracture.

1.4.2Basilar Fracture and Diastatic Fracture

Typically seen in newborns and older infants, diastatic fractures occur when the skull's suture lines (areas where the bones fuse together during childhood) are widened.

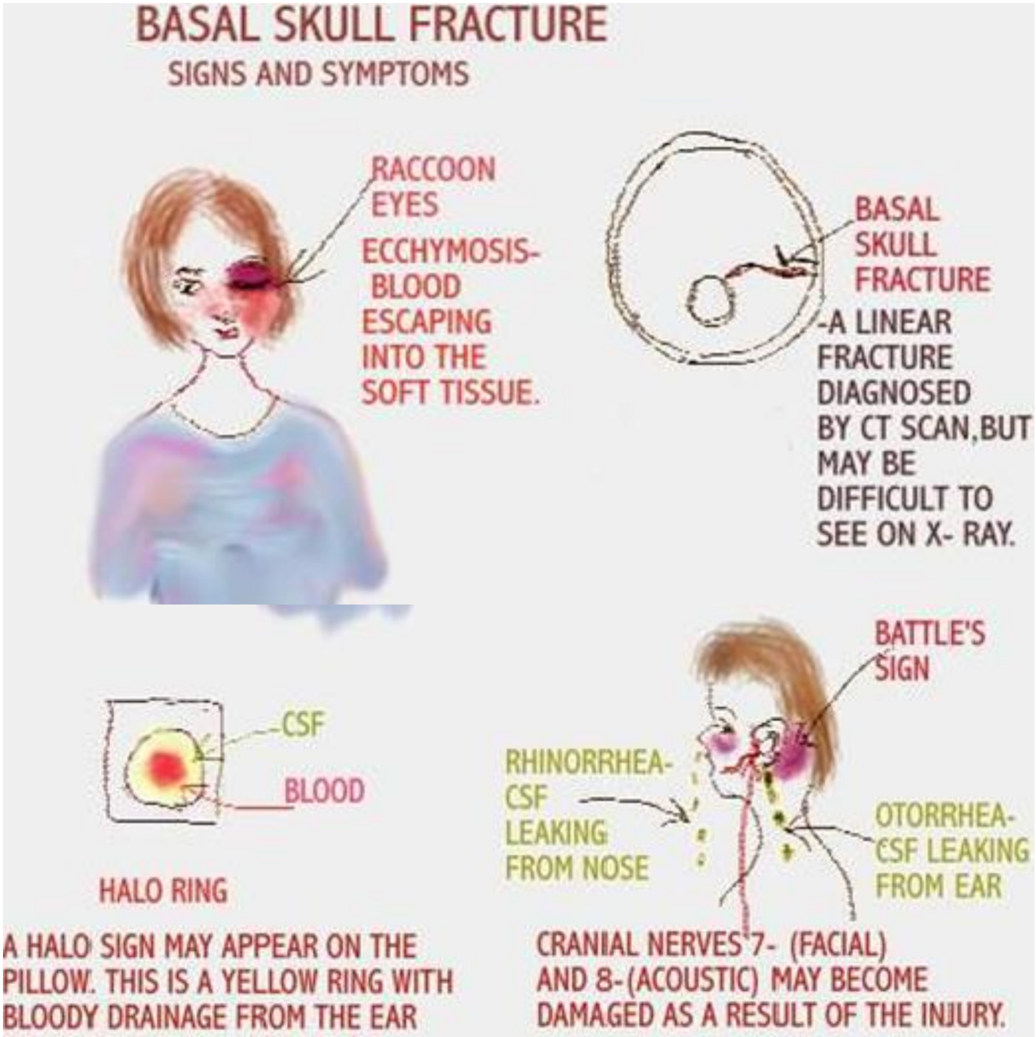


Figure 3(basal skull fructure)

1.4.3Depressed Skull Fracture

Are often the result of a severe blow to the head with a blunt object. Unlike linear skull fractures, which only break the surface of the skull, broken skull fragments from depressed skull fractures penetrate or compress brain tissue and can cause severe brain damage.

Open Head Injury Complications

Most open head injuries expose the brain to the outside environment, leaving victims extremely susceptible to infection. If left untreated, infection can cause permanent brain damage or death.

The most common type of infection resulting from open head injuries is meningitis caused by bacteria or viruses, meningitis is usually treated with aggressive antibiotics and drugs that reduce brain swelling (corticosteroids).

In addition to meningitis, open head injury can leave the brain vulnerable to other complications, including:

- Seizures
- Dementia
- Paralysis
- Coma
- Death

All traumatic brain injury victims also risk suffering from intracranial hematoma, or bleeding in the head or brain.

1.5 Symptoms

If symptoms of a head injury are seen after an accident, medical care is necessary to diagnose and treat the injury. Without medical attention, injuries can progress and cause further brain damage, disability, or death.

1.6Common symptoms

Because the brain swelling that produces these symptoms is often a slow process, these symptoms may not surface for days to weeks after the injury. Common symptoms of a closed-head injury include:

- Insomnia
- Memory Problems
- Poor concentration
- Depression
- Anxiety
- Irritability
- Headache
- Dizziness
- Fatigue
- Noise/light intolerance

1.7 Classification of TBI

- Primary
    - Injury to scalp, skull fracture
    - Surface contusion/laceration
    - Intracranial hematoma
    - Diffuse axonal injury, diffuse vascular injury

- Secondary
    - Hypoxia-ischemia, swelling/edema, raised intracranial pressure
    - Meningitis/abscess

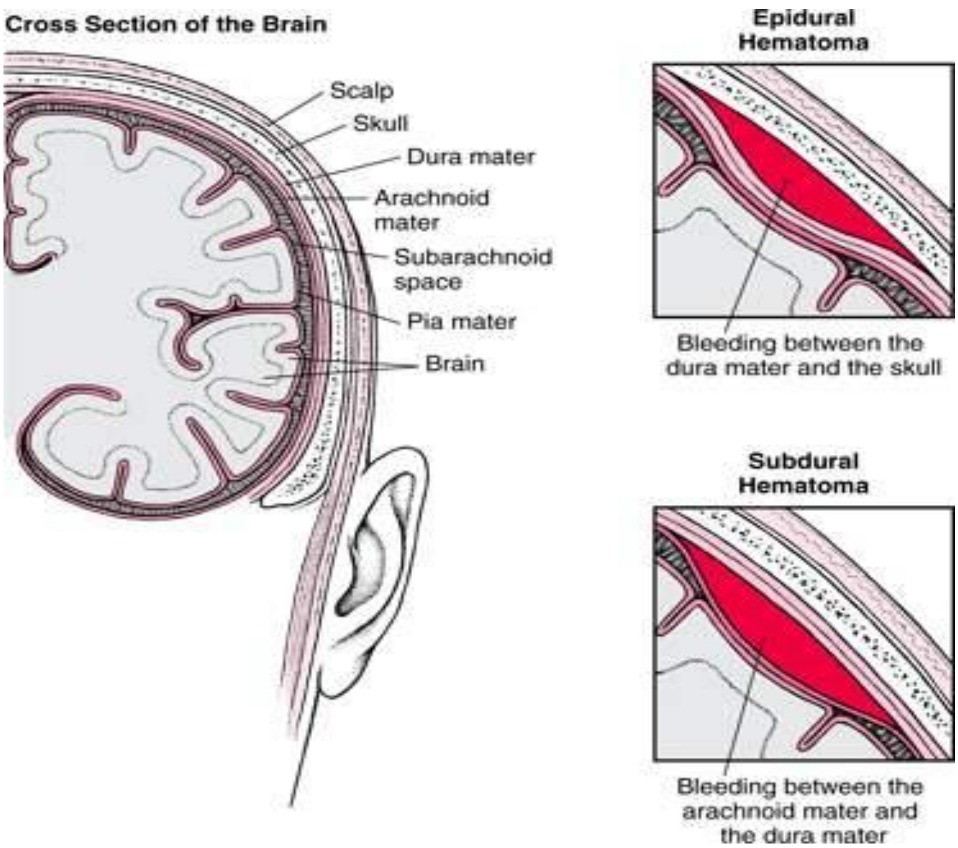


Figure 4(cross section of brain)

1.8 How violence affects individuals of Traumatic Brain Injury?

TBI, light in terms of symptoms, depending on the width of the damage in the brain, are rated as moderate to severe. Light levels of damage or loss of consciousness may be a few seconds / minutes short term could result in loss of consciousness.Headache, confusion, dizziness, blurred vision or eye fatigue, tinnitus, a bad taste in the mouth, fatigue, impaired sleep patterns, behavior or in changes in mood and memory, concentration, livable small problems with attention and thinking.

Mild head trauma can be healed who most people.Although seen moderate or these symptoms are severe damage, in addition to their deteriorating or exceeding headaches, recurrent vomiting or nausea, transfer or seizures, sleep, wake up to, expansion of pupils, obscurity speech, weakness or numbness in the arms.

And legs, loss of coordination, and increased confusion, restlessness, nervousness, anxiety, tension can be observed in such cases; Some damage can be fatal if it is.

1.9What are the common causes of Traumatic Brain Injury?

TBI's are the most common causes of road traffic accidents (often a car, motorbike accidents). Among other reasons, falls, sports injuries, work accidents, violence and child abuse can be considered.

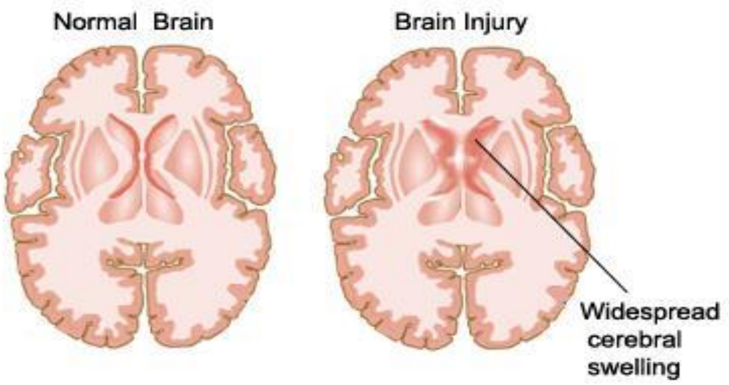


Figure 5(brain injury)

1.10 Is there a relationship between age of traumatic brain injury?

In the 15-24 year old male, depending on the default way of life that the risk is likely to occur.

Individuals over the age of 75 are exposed to the trauma caused by falls is much more.Adolescents and adults are the most common cause for offenses including automobile and motorcycle accidents and violence.

Depending on the military profession, in professions such as the police may be common to bullet injuries. In infants under one year of age may be the most common cause of physical abuse.

In particular game or for very severe shaking damage can lead to brain damage. Slightly larger than the pre-school are frequently found to damage resulting from falling in children. And after five years are pedestrians or cyclists artabili injuries.

1.11 What changes occur as people with Traumatic Brain Injury?

Depending on the areas of the brain are damaged physical, behavioral or mental changes may occur. Many injuries may be limited to a small area of the brain. This little damage is often located at the head hits an object or objects that enter the brain. widespread damage, especially in closed head injury which affected several areas of the brain can be seen. This common types of injuries occur due to commute back and forth inside the skull of the brain. Frontal (front) and temporal (side) lobes, therefore, speech and language areas are mostly affected in this way. Speech and language areas that often damage usually occurs communication difficulties. Other problems are as follows: voice disorders, difficulty in swallowing, walking, balance, coordination, smell, lack of memory and cognitive skills.

1.12 What is Traumatic Brain Injury resulting from linguistic and cognitive problems?

These problems vary from person to person.Personality, individual differences are seen according to the severity of the injury before the skills and brain damage.

The effect is more immediately after the injury of brain injury. However, some effects of TBI can be misunderstood. The new damaged brain tissue is often swelling (edema), bruises and sores are present.

This type of damage is usually not permanent; functions of these areas may come back after passing swelling and sores. Therefore, long-term in the first week after TBI is difficult to estimate precisely the problem. However, even minor damage to permanent, long-term may cause problems. Undamaged areas of the brain can be observed development and explore ways to begin to fulfill the functions of the damaged area.

Children's brains that resilience than adults (plasticity) are more prone to. Therefore, having the same damage children may show better progress than adults. Cognitive problems possible cognitive problems in patients with conscious counted as follows: a decrease in attention span, difficulty in organizing thoughts, forgetfulness, confusion, and sometimes difficulty in learning new information, inability to interpret the movements of other people , does not act in accordance with the social situation, problem solving, decision making and planning difficulties. linguistic problems shows individual differences such as language problems, cognitive problems.Some of the language-related problems: the difficulty of the word; Game theory proper sentences; long and often false narratives or descriptions; difficulty understanding the words; joke or different uses of humor, statements, suggestive use of incomprehension; irascibility sometimes accordingly and to be aware of their error; decline in reading and writing skills; deterioration in math skills. problems related to speech and speech intelligibility problems encountered in people with TBI are also observed. Normally slow, incomprehensible, in the form of a conversation can be heard mumbling in the mouth. This is because the muscles of the body is damaged the brain areas that control speech. This type is a speech disorder called dysarthria.

1.13 What Interventions are Performed in traumatic brain injury ?

TBI to people who need medical attention first.Supplemental oxygen to the brain and the rest of the body and ensure adequate blood flow is primarily to control blood pressure. X-ray, CT, MR imaging techniques such as TBI is very important in determining the patient's diagnosis

Required medical and surgical interventions, and after viewing the damage is done to diagnose. with individual therapy programs are organized according to the patient during the subsequent periods. These programs, physiotherapy, occupational therapy, speech and language therapyit may be in the form of psychological and social solidarity.

1.14 Brain Hemorrhage: Causes, Symptoms, Treatments

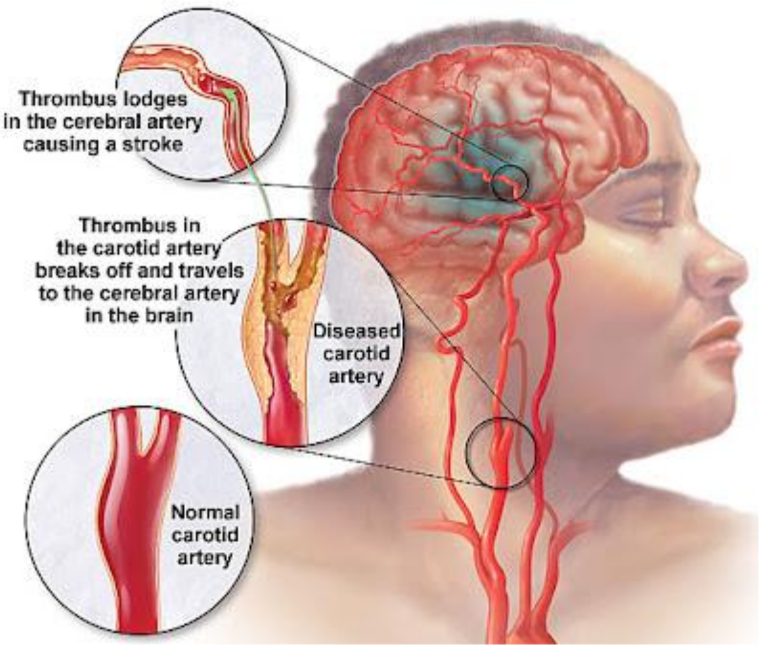


Figure 6(brain hemorrhage)

A brain hemorrhage is a type of stroke. It's caused by an artery in the brain bursting and causing localized bleeding in the surrounding tissues. This bleeding kills brain cells.

The Greek root for blood is hemo. Hemorrhage literally means "blood bursting forth." Brain hemorrhages are also called cerebral hemorrhages, intracranial hemorrhages, or intracerebral hemorrhages. They account for about 13% of strokes.

1.15 Happens During a Brain Hemorrhage?

When blood from trauma irritates brain tissues, it causes swelling. This is known as cerebral edema. The pooled blood collects into a mass called a hematoma. These conditions increase pressure on nearby brain tissue, and that reduces vital blood flow and kills brain cells.

Bleeding can occur inside the brain, between the brain and the membranes that cover it, between the layers of the brain's covering or between the skull and the covering of the brain.

1.16 What Causes Bleeding in the Brain?

There are several risk factors and causes of brain hemorrhages. The most common include:

- **Head trauma**. Injury is the most common cause of bleeding in the brain for those younger than age 50.
- **High blood pressure**. This chronic condition can, over a long period of time, weaken blood vessel walls. Untreated high blood pressure is a major preventable cause of brain hemorrhages.
- **Aneurysm**. This is a weakening in a blood vessel wall that swells. It can burst and bleed into the brain, leading to a stroke.
- **Blood vessel abnormalities**. (Arteriovenous malformations) Weaknesses in the blood vessels in and around the brain may be present at birth and diagnosed only if symptoms develop.
- **Amyloid angiopathy**. This is an abnormality of the blood vessel walls that sometimes occurs with aging and high blood pressure. It may cause many small, unnoticed bleeds before causing a large one.
- **Blood or bleeding disorders**. Hemophilia and sickle cell anemia can both contribute to decreased levels of blood platelets.
- **Liver disease**. This condition is associated with increased bleeding in general.
- **Brain tumors**.

1.17 What Are the Symptoms of Brain Bleeding?

The symptoms of a brain hemorrhage can vary. They depend on the location of the bleeding, the severity of the bleeding, and the amount of tissue affected. Symptoms may develop suddenly or over time. They may progressively worsen or suddenly appear.

If you exhibit any of the following symptoms, you may have a brain hemorrhage. This is a life-threatening condition, and you should go to an emergency room immediately. The symptoms include:

- A sudden severe headache

- Seizures with no previous history of seizures
- Weakness in an arm or leg
- Nausea or vomiting
- Decreased alertness; lethargy
- Changes in vision
- Tingling or numbness
- Difficulty speaking or understanding speech
- Difficulty swallowing
- Difficulty writing or reading
- Loss of fine motor skills, such as hand tremors
- Loss of coordination
- Loss of balance
- An abnormal sense of taste
- Loss of consciousness

Keep in mind that many of these symptoms are often caused by conditions other than brain hemorrhages.

1.18 How Is a Brain Hemorrhage Treated?

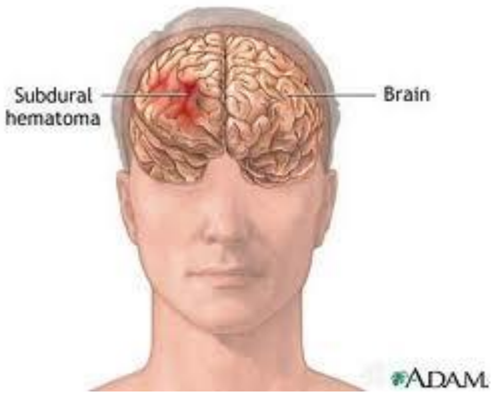


Figure 7(hematoma)

Once you see a doctor, he or she can determine which part of the brain is affected based on your symptoms.

Doctors may run a variety of imaging tests, such as a CT scan, which can reveal internal bleeding or blood accumulation, or an MRI. A neurological exam or eye exam, which can show swelling of the optic nerve, may also be performed.

A lumbar puncture (spinal tap) is usually not performed, as it may be dangerous and make things worse.

Treatment for bleeding in the brain depends on the location, cause, and extent of the hemorrhage. Surgery may be needed to alleviate swelling and prevent bleeding. Certain medications may also be prescribed. These include painkillers, corticosteroids, or diuretics to reduce swelling, and anticonvulsants to control seizures.

1.19Can People Recover From Brain Hemorrhages, and Are There Possible Complications?

How well a patient responds to a brain hemorrhage depends on the size of the hemorrhage and the amount of swelling.

Some patients recover completely. Possible complications include stroke, loss of brain function, or side effects from medications or treatments. Death is possible, and may quickly occur despite prompt medical treatment.

1.20 Can a Brain Hemorrhages Be Prevented?

Because the majority of brain hemorrhages are associated with specific risk factors, you can minimize your risk in the following ways:

- **Treat high blood pressure.** Studies show that 80% of cerebral hemorrhage patients have a history of high blood pressure. The single most important thing you can do is control yours through diet, exercise, and medication.
- **Don’t smoke.**
- **Don’t use drugs.** Cocaine, for example, can increase the risk of bleeding in the brain.
- **Drive carefully, and wear your seat belt.**
- **If you ride a motorcycle, always wear a helmet.**

- **Investigate corrective surgery.** If you suffer from abnormalities, such as aneurysms, surgery may help to prevent future bleeding.
- **Be careful with Coumadin.** If you take this drug, also called warfarin, follow up regularly with your doctor to make sure your blood levels are in the correct range.

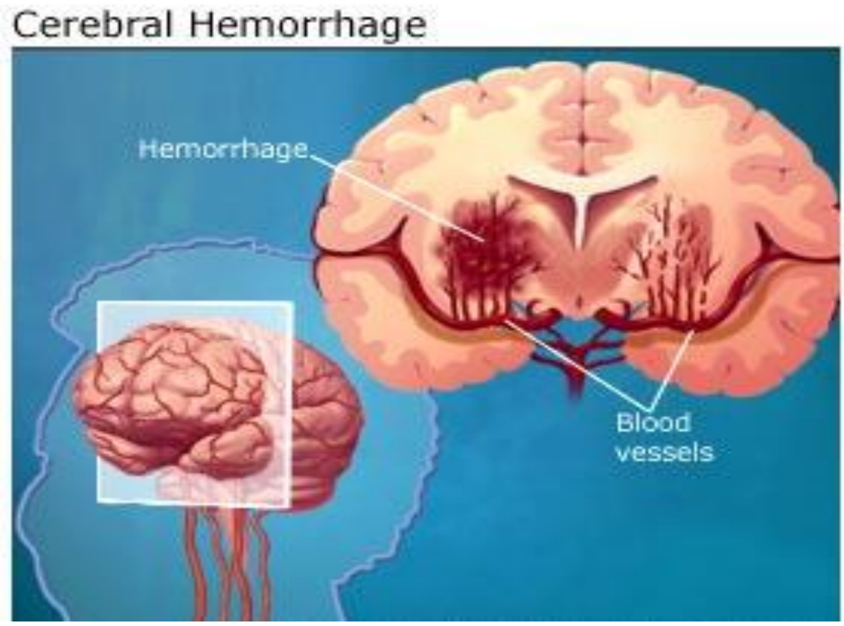


Figure 8(cerebral hemorrhage)

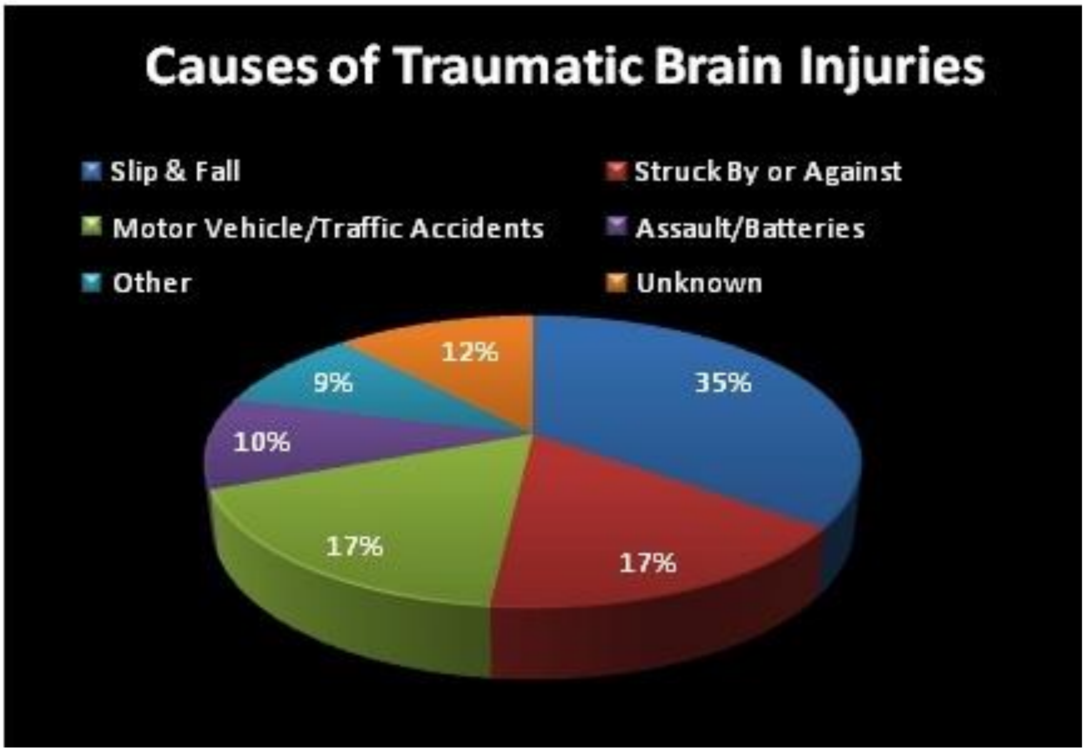


Figure 9 (causes of traumatic brain injuries)

2.1 SENSOR

A **sensor** is a device that detects events or changes in quantities and provides a corresponding output, generally as an electrical or optical signal; for example, a thermocoupleconverts temperature to an output voltage. But a mercury-in-glass thermometer is also a sensor; it converts the measured temperature into expansion and contraction of a liquid which can be read on a calibrated glass tube.

Sensors are used in everyday objects such as touch-sensitive elevator buttons (tactile sensor) and lamps which dim or brighten by touching the base, besides innumerable applications of which most people are never aware.

With advances in micromachinery and easy-to-use microcontroller platforms, the uses of sensors have expanded beyond the more traditional fields of temperature, pressure or flow measurement, for example into MARG sensors.

Moreover, analog sensors such as potentiometers and force-sensing resistors are still widely used. Applications include manufacturing and machinery, airplanes and aerospace, cars, medicine and robotics.

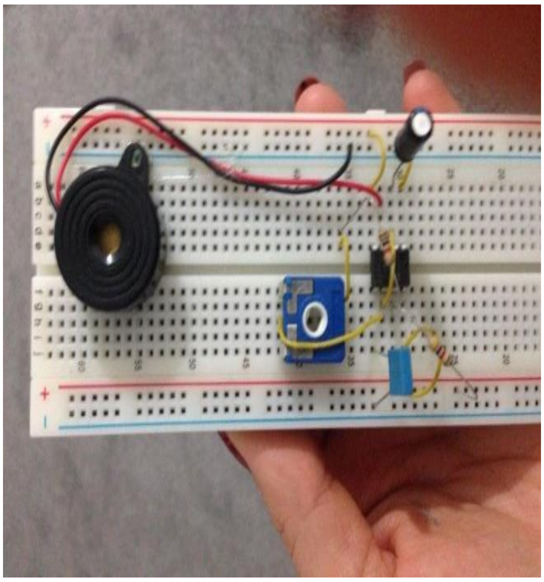
A sensor's sensitivity indicates how much the sensor's output changes when the input quantity being measured changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1 °C, the sensitivity is 1 cm/°C (it is basically the slope Dy/Dx assuming a linear characteristic). Some sensors can also have an impact on what they measure; for instance, a room temperature thermometer inserted into a hot cup of liquid cools the liquid while the liquid heats the thermometer. Sensors need to be designed to have a small effect on what is measured; making the sensor smaller often improves this and may introduce other advantages. Technological progress allows more and more sensors to be manufactured on a microscopic scale as microsensors using MEMS technology. In most cases, a microsensor reaches a significantly higher speed and sensitivity compared with macroscopic approaches.

2.2Names of the Materials

- Resistors (4.7kΩ & 1 kΩ)
- Buzzer
- Potentiometer (100 kΩ)
- Battery (9V)
- Capacitor(100 nF & 10 µF)
- Multimeter
- 555 integrated
- Vibration motor
- Electric pipe
- Screw
- Spring
- Single copper wire
- Cables

DESIGN

3.1This is the first simple circuit that i've designed ;



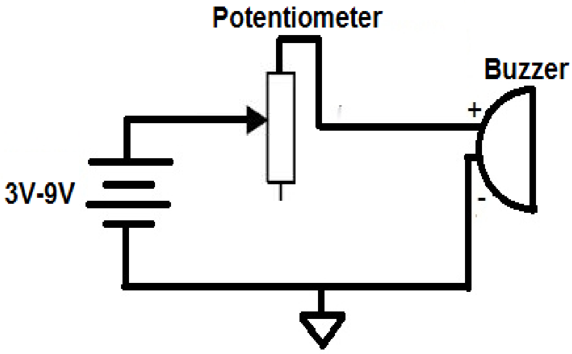


Figure 10(circuit diagram)

Figure 11 (potentiometer circuit)

Prepaed Potentiometer circuit and added 555 timer and buzzer to the circuit. This part will make the device give alarm with loud sound at certain intervals.

3.2 This is the first designed sensor unit ;

Figure 12(simple sensor unit)

Used copper wire, spring, screw and a metal ball. Then I put it into an insulated electric pipe.This part will be cabled to the circuit.

3.3 Making of the device ;

This circuit was designed to work potentiometer. I use the 555 timer, buzzer, resistors, cables .This circuit will be connected to a small box. And the remaining materials to be soldered into this box.Electricity transmission with copper wires and a metal ball will occur.This unit is placed on the patient's head.If the patient tries to sleep , the device give an alarm very soundly.

3.4 New design of the device

Figure 13(copper circuit)

I used copper circuit in the new design. Plastic board part is removed. Printed circuit board is the most common name but may also be called “printed wiring boards” or “printed wiring cards”.Then copper circuit diagram is drawn. We draw this circuit with the help of Proteus program. Then we put the acid solution and the circuit is completed .

3.5 This is the new circuit

Figure 14(when the drill of the circuit)

Then the points where the circuit elements will be placed were determined, and the circuit diagram were drilled for mounting. Thus, it has become smaller than the old circuit.

Figure 15(main circuit)

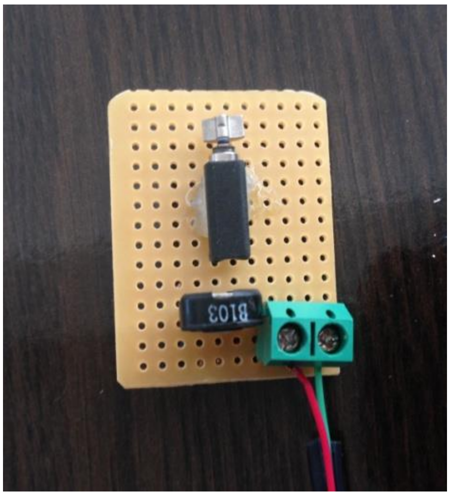


Figure 16(vibration circuit)

In addition, I've soldered the circuit elements to the copper to make it more robust. I’ve added a small vibration motor with the help of additional circuits. if the patient shows resistance to sound due to hearing loss system will help the patients with its vibration option.

3.6 New sensor unit

Figure 17(sensor part)

On the sensor side, i’ve shortened the pipe section. I chose to use shorter copper wires. Thus, sensitivity of the device increases.

Then , I have combined simple bio-sensor and an electrical circuit to create a device that gives an alarm with loud sound and vibration at certain intervals to keep patients awake in necessary sitiuations.

4.1 RESISTOR

Figure18 (resistor)

A **resistor** is a passive two-terminal electrical component that implements electrical resistance as a circuit element. Resistors act to reduce current flow, and, at the same time, act to lower voltage levels within circuits. In electronic circuits resistors are used to limit current flow, to adjust signal levels, bias active elements, terminate transmission lines among other uses. High-power resistors that can dissipate many watts of electrical power as heat may be used as part of motor controls, in power distribution systems, or as test loads for generators. Resistors can have fixed resistances that only change slightly with temperature, time or operating voltage.

Variable resistors can be used to adjust circuit elements (such as a volume control or a lamp dimmer), or as sensing devices for heat, light, humidity, force, or chemical activity.

Resistors are common elements of electrical networks and electronic circuits and are ubiquitous in electronic equipment. Practical resistors as discrete components can be composed of various compounds and forms. Resistors are also implemented withinintegrated circuits.

The electrical function of a resistor is specified by its resistance: common commercial resistors are manufactured over a range of more than nine orders of magnitude.

4.2 INTEGRATED CIRCUIT

Figure 19 (integrated circuit)

An **integrated circuit** or **monolithic integrated circuit** (also referred to as an **IC**, a **chip**, or a **microchip**) is a set of electronic circuits on one small plate ("chip") of semiconductor material, normally silicon. This can be made much smaller than a discrete circuit made from independent components. ICs can be made very compact, having up to several billion transistors and other electronic components in an area the size of a fingernail. The width of each conducting line in a circuit can be made smaller and smaller as the technology advances; in 2008 it dropped below 100 nanometers,[1] and now is tens of nanometers.

ICs were made possible by experimental discoveries showing that semiconductor devices could perform the functions of vacuum tubesand by mid-20th-century technology advancements in semiconductor device fabrication. The integration of large numbers of tinytransistors into a small chip was an enormous improvement over the manual assembly of circuits using discrete electronic components.

The integrated circuit's mass production capability, reliability and building-block approach to circuit design ensured the rapid adoption of standardized integrated circuits in place of designs using discrete transistors.

ICs have two main advantages over discrete circuits: cost and performance. Cost is low because the chips, with all their components, are printed as a unit by photolithography rather than being constructed one transistor at a time.

Furthermore, packaged ICs use much less material than discrete circuits. Performance is high because the IC's components switch quickly and consume little power (compared to their discrete counterparts) as a result of the small size and close proximity of the components. As of 2012, typical chip areas range from a few square millimeters to around 450 mm^2, with up to 9 million transistors per mm^2.

Integrated circuits are used in virtually all electronic equipment today and have revolutionized the world of electronics. Computers, mobile phones, and other digital home appliances are now inextricable parts of the structure of modern societies, made possible by the low cost of integrated circuits.

4.3 POTENTIOMETER

Figure 20 (potentiometer)

A **potentiometer** is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider.[1] If only two terminals are used, one end and the wiper, it acts as a **variable resistor** or **rheostat**.

A potentiometer measuring instrument is essentially a voltage divider used for measuring electric potential (voltage); the component is an implementation of the same principle, hence its name.

Potentiometers are commonly used to control electrical devices such as volume controls on audio equipment. Potentiometers operated by a mechanism can be used as position transducers, for example, in a joystick.

Potentiometers are rarely used to directly control significant power (more than a watt), since the power dissipated in the potentiometer would be comparable to the power in the controlled load.

4.4 CAPACITOR

Figure 21 (capacitor)

The capacitance of the majority of capacitors used in electronic circuits is generally several orders of magnitude smaller than the farad.

The most common subunits of capacitance in use today are
the microfarad (μF), nanofarad (nF), picofarad (pF), and, in microcircuits, femtofarad (fF). However, specially made supercapacitors can be much larger (as much as hundreds of farads), and parasitic capacitive elements can be less than a femtofarad.

Capacitance can be calculated if the geometry of the conductors and the dielectric properties of the insulator between the conductors are known. A qualitative explanation for this can be given as follows.
Once a positive charge is put unto a conductor, this charge creates an electrical field, repelling any other positive charge to be moved onto the conductor.

I.e. increasing the necessary voltage. But if nearby there is another conductor with a negative charge on it, the electrical field of the positive conductor repelling the second positive charge is weakened (the second positive charge also feels the attracting force of the negative charge).

So due to the second conductor with a negative charge, it becomes easier to put a positive charge on the already positive charged first conductor, and vice versa. I.e. the necessary voltage is lowered.

4.5 BUZZER

Figure 22(buzzer)

A **buzzer** or **beeper** is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers and confirmation of user input such as a mouse click or keystroke.

4.6 Vibration motor

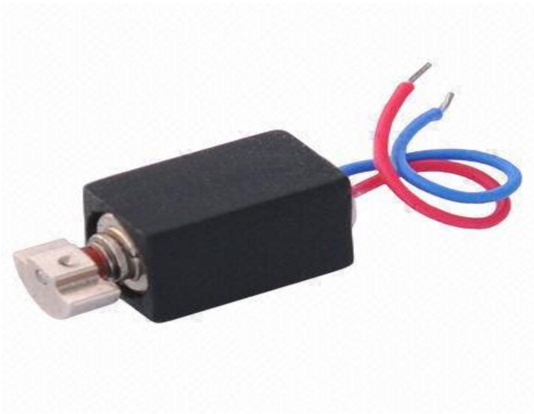


Figure 23(vibration motor)

Vibration motor is a mechanical device to generate vibrations. The vibration is often generated by an electric motor with an unbalanced mass on its driveshaft.

There are many different types of vibrator. Some are components of larger products such as cellphones, pagers.

CONCLUSION

Overall my project went as planned. Our aim is to keep a patient who had these

kinds of injuries awake and prevent an attack during the sleep.

In theoretically parts of my project, i talked to a doctor and this talking was related my project to create an idea in my minds. Then i started to build my project by defining the equipments.

In experimentally parts of my project, I have combined simple bio-sensor and an electrical circuit to create a device that gives an alarm with loud sound and vibration at certain intervals to keep patients awake in necessary sitiuations.

As a summary,we have designed ;

*Simple

* Low cost

*Portable

*It will be assist device

* And of a kind system for my aim.

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APPENDICES

*APPENDIX 1

circuit diagram

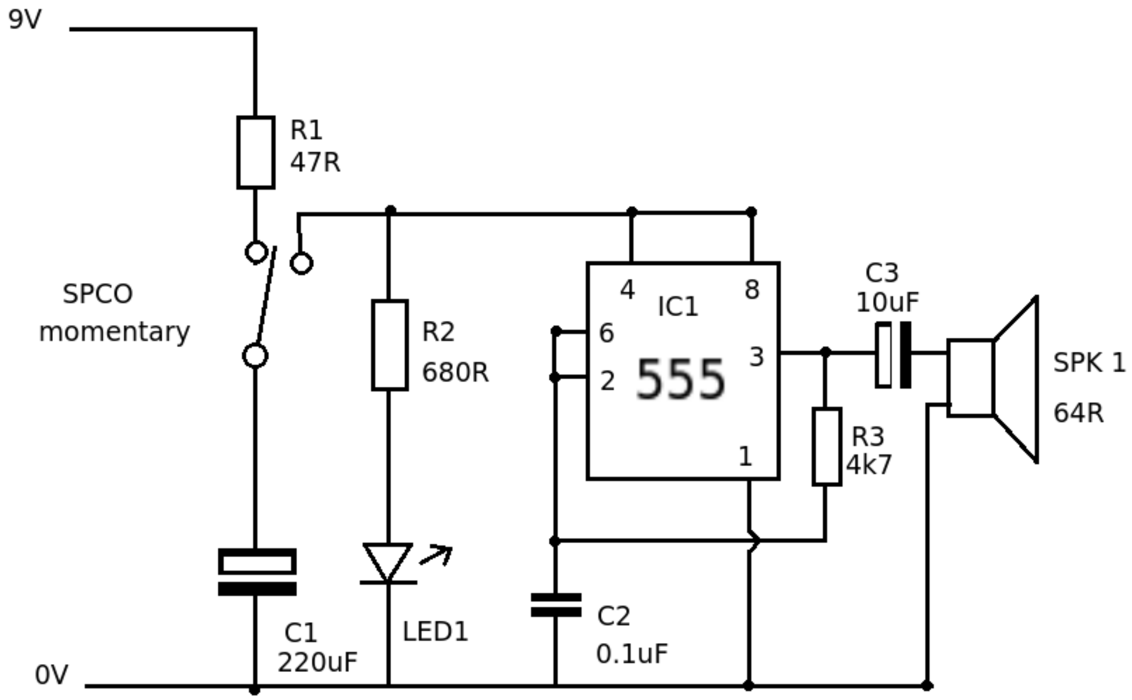
*APPENDIX 2

555 Integrated

*APPENDIX 3

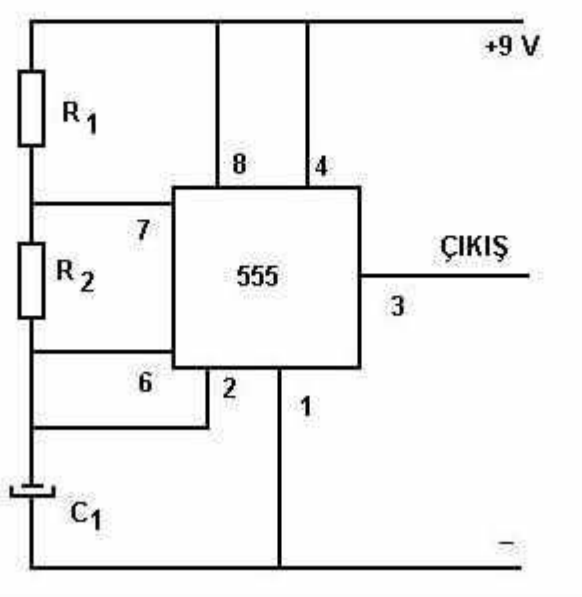
Vibration circuit

APPENDIX 1


9V
R1
47R
SPCO
momentary
R2
680R
4
IC1
8
6
2
555
3
1
C3
10uF
SPK 1
64R
R3
4k7
C1
220uF
LED1
C2
0.1uF
0V

APPENDIX 2

Time monastabl multivibrator 555 Integrated Circuit (asymmetric square wave oscillator), astab- la multivibrator (symmetrical square wave oscillator) can be used as a simple application you will understand better with the logic circuits



This determines the frequency DVERI R1, R2 and R3. 3 pin is the frequency of the output end.

Circuit was Periodic

T = 0.693 * (R1 + 2.R2) .C1 dr.

As you know, here is the frequency;

T = 1 / F located at the.

Units

T = Periodic (seconds)

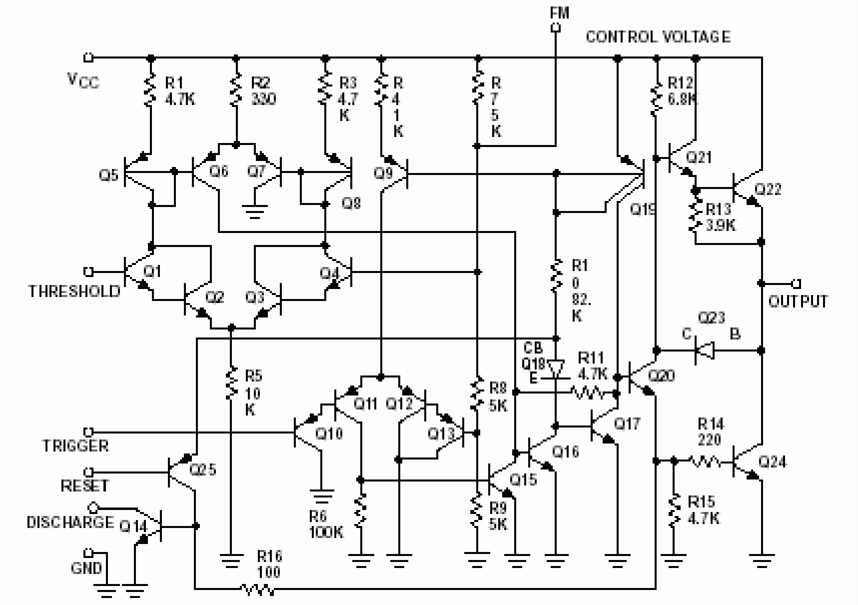
F = Frequency (1 / seconds) (or cycles / second)

R1 = Resistance (Ohms)

R2 = Resistance (Ohms)

C1 = capacitor (Farad)

Internal structure of the integrated



555 integrated circuit pin (pin) connections

1-Ground Soil foot

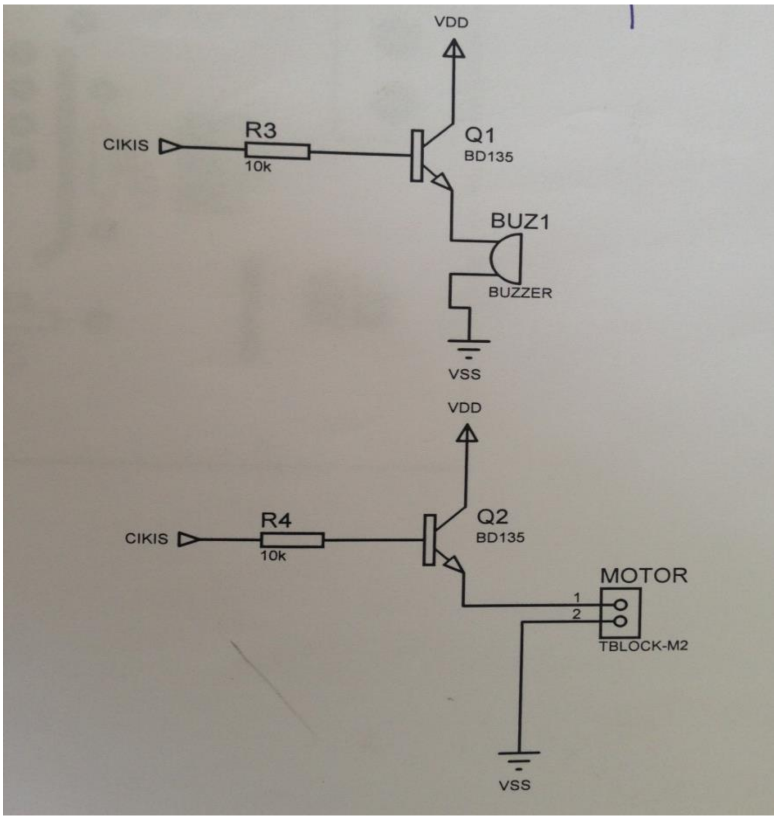
2-Trigger: This pin is used as a foot in the monostable trigger application. The lower comparator - a voltage when the flip-flop set legs under the standing 1/3 Vcc connected to the input is logic 1 and therefore the flip-flop Q output is logic 1.

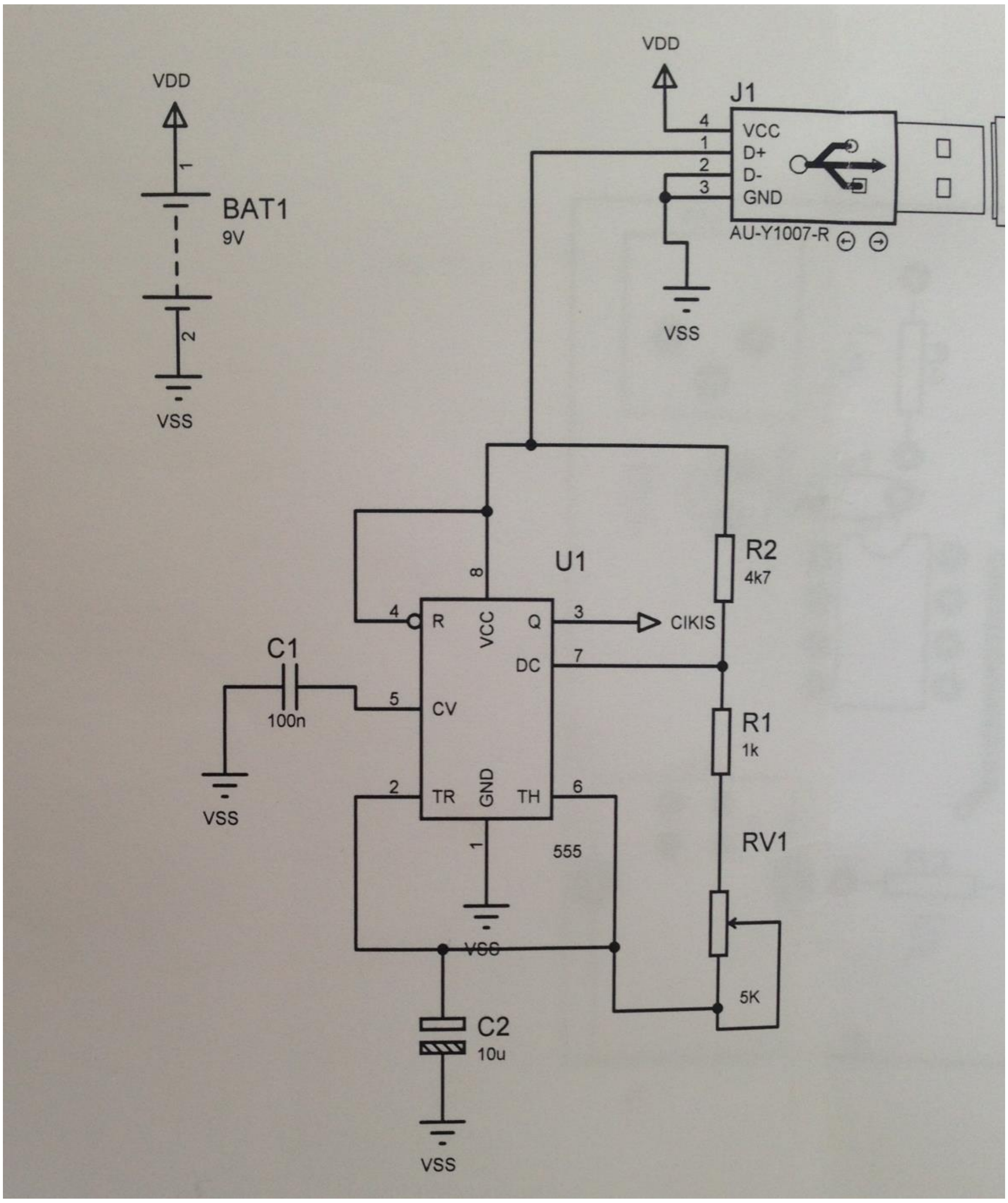
3-Output: Output foot

4-Reset: This foot logic 0 when reset and the Q output of the logic circuit makes is 0. Reset foot is not connected to the other pin.

5-Control: 2/3 Vcc voltage range points connected with this standing tension by changing the timing period can be changed if desired. Normally connected to the ground with a small capacity.
6-Threshold: 2/3 throws reset flip-flop when the voltage on Vcc.
7-Discharge: NPN transistor is connected to the collector feet. When my transistor message (the base voltage is positive when) is connected to the ground legs.
8-Vcc: + 4.5V + 16V voltage is supplied between.

APPENDIX 3




VDD
BAT1
9V
VSS
VDD
J1
VCC
D+
D-
GND
AU-Y1007-R
VSS
U1
R
VCC
Q
CIKIS
DC
CV
TR
GND
TH
555
C1
100n
VSS
R2
4k7
R1
1k
RV1
5K
VSS
C2
10u
VSS