DESIGN AND CONSTRUCTION OF A CAR PARKING AID DEVICE.

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DEDICATION

This project is dedicated to the entire family of Elder & Mrs R.A Owosuhi who never ceased believing in me and to God Almighty who has not disappointed me.

DECLARATION.

I *Owosuhi Adedayo A.*, declare that this work was done by me and has never been presented elsewhere for the award of a degree. I also hereby relinquish the copyright to the Federal University of Technology, Minna.

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At this junction ,I tender my unreserved apology to every person whose name ought to appear but have not. Your effort is highly recognized and appreciated. Thanks for being part of the investment in my life.

ABSTRACT

This project is the design and construction of an automatic car parking aid which is a Proximity alert device that enables drivers to park their cars in their garages without having a fender bender. The car parking aid is an external device that consists of both a transmitter and receiver that use the principle of infra-red transmission and reception. The transmitter is able to trigger the LED and the sound alarm when the car is within some distance so as to enable it stop. In this case the distance is 25cm Preset Top down approach was used in the design, and implementation of this project ,whereby the system was broken down into simple blocks. This project was successfully implemented using the cheapest and most available electronics components. Bearing in mind the economic viability of the entire system.

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CHAPTER ONE.

GENERAL INTRODUCTION.

1.1 INTRODUCTION.

The state of technology in this present age allows transforming a vehicle to a computerized communication center, which provides information of any kind. Vehicle manufacturers use these possibilities and build in different systems of personal communication into their cars, such as location-aware services, restaurant guides, lookup services for nearby gas stations, economical transactions, voice based email access. These functions must be shared with and have destructive influence on drivers. Car parking aid systems must guide the attention of the driver to the primary task which is parking the car safely. So the main goal of such systems is to minimize collision or totally eradicate it. The success of collision warning systems depends on how well the algorithm and driver interface are tailored to driver capabilities and preferences. A series of recent studies have investigated how various algorithms and algorithm parameters influence collision warning effectiveness. The Algorithms calculate when to issue a warning and have a strong effect on the safety benefit of collision systems, but the driver interface may have an equally important effect.

The driver interface influences how quickly the driver respond and whether the driver will accept the system.Two critical factors govern the effectiveness of collision warning systems[2]. First, the collision warning system must promote a timely and appropriate driver response.Secondly,annoyance associated with nuisance warnings must be minimized and drivers must trust the System if drivers are to accept it. Graded

and single stage warnings represent distinct strategies of presenting warning of information that have important implications for driver performance and acceptance.

1.2. AIMS AND OBJECTIVES.

- The aim of this project is to design an alert device or warning device that senses the distance between vehicles and obstacle in an indoor environment . It is also intended to aid drivers to park in a segmented lot available. It assist the driver to know exactly when to stop his car when driving head-on to prevent the bumper from hitting the wall.
- The objectives of this project is to design an alarm warning system to safe guard the bumpers of the cars from ceaseless damages and to alert the driver on how close he is to an obstacle

1.3. METHODOLOGY.

The project is achieved by placing the transmitter(optical source) and the receiver(photo detector) to the bumper of your car .The transmitter and the receiver units are both connected to power supply (5v) and the switch is pressed on/off.

Once the car is turned on, the transmitter and the receiver units are being powered. The sound alarm beeps and the LED is triggered on simultaneously when the distance between the car and the obstacle is 25cm away

1.4. SCOPE OF WORK

This device is much suitable for use in an indoor environment. The simple reason for this is just because there is no reflection of sun rays in an indoor arena.It has been discovered that sunlight has infrared ray within it and this can cause interference to the transmitted signal when used outdoor.

CHAPTER TWO.

LITERATURE REVIEW.

2.1. HISTORICAL BACKGROUND.

Earliest records of a car parking aid device was dated as far back as 20th century[2].Among the early car aid device was a graded warning which present a signal proportion to the degree of threat ,such that a loud audio signal is heard as the driver approaches an obstacle. A single stage warning provides signal when the degree of threat exceeds a threshold .

Lerner[3] offers extensive guidelines for the design of 7 optical, acoustical and tactile warnings. In general, he recommends the use of multi level warning systems: At least one pre-warning followed by amore immersive one. Prior to the evolution of Car Parking Aid system: there have been a number of devices which served as proximity alert devices to drivers and aided them in parking their vehicles in their personal garages. Another device that aids in parking cars properly is the laser guided garage car parking guide aid system which helps you know exactly where to park your vehicle when driving into your garage without the risk of damage to your vehicle or property. Simply mount the unit on the ceiling of the garage directly above the point you select on your vehicle. Once the garage door is fully open, a bright red laser beam illuminates down from the ceiling unit so you can drive forward until it hits the spot you selected on your car[7].The unit has a laser activation switch that attaches to the top of your garage door track so it activates only when the door is fully open. This will also alert you when it is safe to back up. The system works by radiating ultrasonic beams covering the area

behind the vehicle. The beams are reflected by obstructions behind the vehicle, and re-enter the sensors. The reflected beam information is processed to calculate the distance of the obstruction[7]. In the same vain the Dolphin unit was developed and is activated when reverse gear is engaged. As the vehicle is being reversed and the vehicle is less than 1.5 meters from the wall the audible alert will emit intermittent bleeps[8].

2.2. THEORETICAL BACKGROUND.

The project is achieved by connecting the transmitter and the receiver unit to a DC supply of the car which range 9-12V.Current drawing LED of 40mA and a buzzer is use as the output unit .The infra-red Phototransistor T_2, should be of the type incorporating an optical sunlight filter: these components appear in black plastic cases. Some of them resemble TO92 transistors:•Sunlight or artificial light should be avoided hitting directly D_1 & T_1 because sun has infrared waves in it. This can cause interference. It is wiser to place all the circuitry near the infra-red LEDs in a small box. The best setup is obtained by bringing D_1 nearer to T_1. Usually distance lies in the range 1.5-3 cm.

Materials used in the project are analyzed below.

2.2.1. Resistors: Electrical materials could be divided into conductors, semiconductors and insulators. The parameter used to determine this classification is the resistivity (ρ) of such materials. Good conductors are usually metals and have resistivities in the order of 10^{-7} to 10^{-8} Ωm, semiconductors have resistivities in the order of 10^{-3} to 3×10^{3} Ωm, and the resistivities of insulators are in the order of 10^{4} to 10^{14} Ωm [5]. The resistance of

an electrical conductor depends on four factors, these being: (a) the length of the conductor,

(b) the cross-sectional area of the conductor, (c) the type of material and (d) the temperature of the material. Resistance, R, is directly proportional to length, l, of a conductor and inversely proportional to cross-sectional area, A, of a conductor, i.e.

$R = \rho l/A$ 2.1

R is measured in Ω, l in m while A in m^2. Resistance is the opposition to the flow of electrons or simply the opposition to electric current [6]. It is required in electronic circuits to limit the current flow, limit the voltage drop and divide the voltage. In combination with capacitor, it is used as filter or it can be used to achieve time constant and so on. The pictures below reveal the different types of resistors used and the circuit representations.

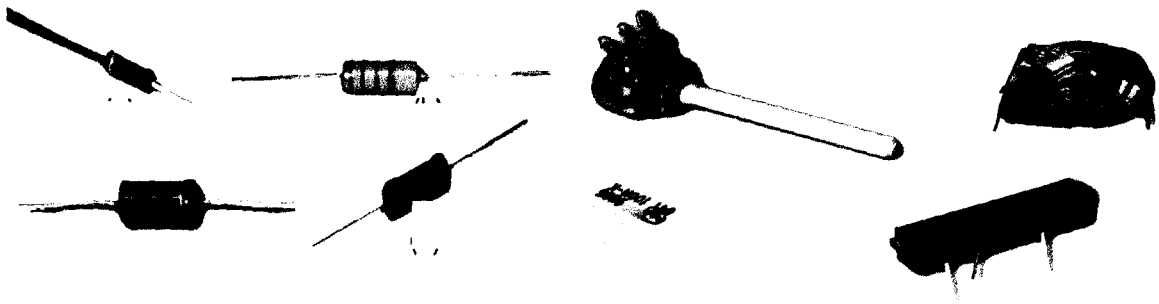


Plate 2.0. Various types of resistors

2.2.2. Capacitors: Two conductors that are not connected and are separated by an insulator constitute a capacitor. When a source of EMF such as a cell is connected to such an arrangement, current flows momentarily, transferring charge (in the form of electrons) from one conducting plate to the other. When a quantity of charge Q (measured in units of

coulombs) has been transferred, the voltage across the plates equals the voltage V across the voltage source. For a fixed arrangement of conductors and insulator, the ratio Q/V is a constant called the capacitance, C.

$Q = CV$ 2.2

Also the quantity of charge stored is related to the period (t) of charge storage and current (I) that flow through it as indicated below

$Q = It$ .....2..3

The picture below shows us the various common capacitors one can find around and the circuit symbol.

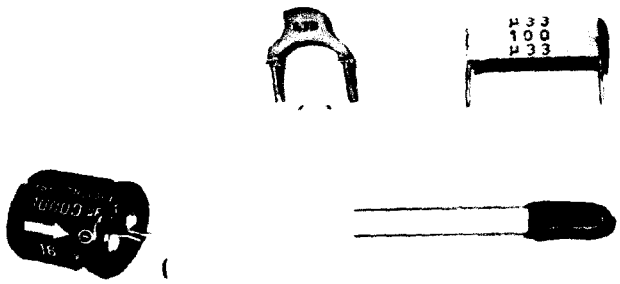


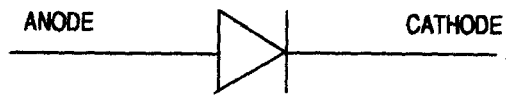
Plate 2.1. Various kind of capacitors.

The capacitor used is an electrolytic capacitor. It was used for timing delay .

2.2.5.Diodes: Semiconductors as we have seen fall into a class of electrical materials whose conductivities lie between that of conductors and insulators. Two charge carriers are used for conduction: the negative charge carriers (electrons) and the positive charge carriers (holes). It is these materials that are used to produce active devices such as diodes, transistors and integrated circuits e.t.c. Silicon (Si) and Germanium (Ge) are common examples of semiconductors. There are two classes of semiconductors: intrinsic semiconductors and extrinsic semiconductors. Intrinsic semiconductors are semiconductors in their pure form. At room temperature, the number of free electrons and holes are insufficient for practical

applications. For such conductors to be useful for practical applications, heat or light must be applied to provide excitation energy to the electrons to liberate them for conduction. Extrinsic semiconductors are semiconductors which are produced by adding impurities to the intrinsic semiconductors (*also known as doping*). Two types of extrinsic semiconductors exist: *N*-type semiconductors and the *P*-type semiconductors. The N-type semiconductors are produced by doping the pure Silicon or Germanium with pentavalent impurity e.g. phosphorus, Arsenic, or antimony while the P-type semiconductors are produced by doping Si or Ge with trivalent impurity e.g. Boron, Aluminium, Gallium or Indium. By doping the pure semiconductor with a pentavalent impurity, we have a semiconductor with excess electrons and by doping the pure semiconductor with trivalent impurity, we have excess holes.

A P-N junction is formed by combining a P-type material with an N-type material together. It has the ability to conduct in one direction only. In the reverse direction, it offers a very high resistance. This P-N junction, with two terminals, one connected to the N-type material and the other to the P-type material is known as the *diode*. The diagram below shows the circuit symbol of a diode. There are different types of diodes: zener diodes, light emitting diodes (LED), tunnel diodes, e.t.c.

The car parking aid pr 

g principal units'

Fig 2.1. Circuit symbol of a diode.

1. A modulated Infra Red transmitter
2. A 38 KHz infra Red sensor

This project is basically operated on the principal of infrared technology so it is important talk about it

2.2.6 The Infra-Red Spectrum: A renowned astronomer William Herschel discovered in the 19th century and he published his result in 1801 before the Uk royal society. He used a prism to refract light from the sun and detected the infrared, beyond the red part of the spectrum, through an increase in temperature recorded on a thermometer.

He was so astonished at the result and called them "caloric rays"[1] .

The IR spectrum technology uses the IR spectrum,which is a region of the Electromagnetic spectrum lying immediately below the visible light spectrum. The IR spectrum consists of Electromagnetic radiation with wavelength extending between the longest visible red (circa 0. 7pm) and the shortest microwaves (circa 300-l000iirn. i.e. from 400Hz down to lTHz—300GHz)

The IR spectrum is further sub divided into the near intermediate and far lR bands on as follows.

(1) Near IR bands: 0.7μm up 3μm (429 THz-100 THz)

(2) Intermediate IR band: 3μm up to l0μm(l00THz -30 THz)

(3) Far IR band: 10μm up to I00μm (30 THz-3 THz)

(4) Sub millimeter: 100μm up to lμm (3 THz-300GHz)

Electromagnetic radiation is produced by oscillating and rotating molecules and atoms. Therefore, all objects at temperature above absolute zero emit EM radiation high virtue of their thermal motion (warmth) alone. Objects near room temperature emit most of

their radiation in the IR band. Even relatively cool objects, however, emit some IR radiation, hot objects such as incandescent filaments, emit strong IR radiation.

IR radiation is sometimes incorrectly referred to as radiant heat: because warm bodies emit IR radiation and bodies that absorbs. IR radiations are warm. Mow IR radiation is not itself heat. This EM radiation is called black body radiation. Such waves are emitted by all material objects. For example, the background cosmic radiation (2.7k) emits microwaves: room temperature object (295k) emits the rays, the sun (6000k) emits yellow light, the solar corona emits (1 x 10exp6 K)) X-rays IR astronomy uses the 1μm-1mm part of the IR band to study celestial object by their

IR emissions IR detectors arc used in night vision systems, intender alarm system, weather forecasting and missile guidance system. IR photography use multilayer colour film with an IR sensitive emulsion in the wavelengths between 700mm and 900mm for medical and forentic application for aerial surveying.

2.2.7Modulated IR Transmitters

This sub-system is designed using the 555 timer or multivibrator chip. It comprises astable square wave oscillator,set to generate 730HZ output Frequency square wave output. The oscillator directly modulates the phototransistor to provide an output that is sensed by a three terminal Infrared sensor.

2.2.8 The Receiver Unit

a. 1.1 seconds 555 monostable

b.Infrared phototransistor:This a light sensitive transistor and it is similar to an ordinary bipolar junction transistor(BJT).Silicon NPNs are mostly used as a photo transistor.The device is usually packed in a TO-type can with lens on top although sometimes it is

encapsulated in clear plastic.The Phototransistor has application similar to photo diode.The main difference are in current and response time. The photo transistor has the advantage of greater sensitivity and current capacity than photo diode[6]. Like diodes all transistors are light sensitive. Phototransistors are designed specifically to take advantage of this fact. It has an exposed base region where the light striking the base replaces what would ordinarily be voltage applied to the base. So a phototransistor is amplifies variation in light striking it.Note that photodiodes also provides a similar function ,although with much lower gain.

c.LED (Light emitting diode):It is a forward biased P-N junction which emit visible light when energized. The colour of the emitted light depend on the type of material used as given below[6].

i.GaAS:infrared radiation(invisible)

ii.GaP:red or green light

iii.GaAsP:red or green light

CHAPTER THREE.

DESIGN AND IMPLEMENTATION.

3.1. INTRODUCTION.

The design and construction of a car parking aid device was based on the modules that are represented in the block diagram shown in fig 3.1 below;

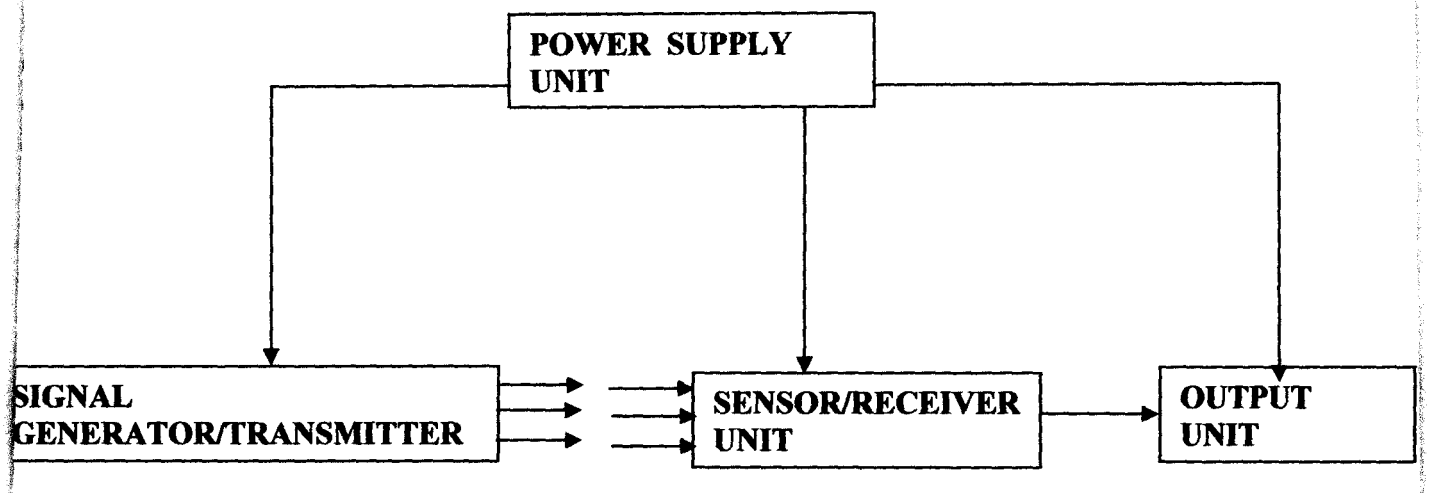


Fig 3.0 Block diagram of A Car parking aid device.

The car parking aid device comprises the following modules:

1. Power supply unit
2. Transmitter unit
3. Sensor unit
4. Output unit

3.2 Power Supply Unit

The simpler type of electricity is called DIRECT CURRENT, abbreviated as "DC". This is the type of electricity that is produced by batteries, static, and lightning. A voltage is created, and possibly stored until a circuit is completed. When it is completed, the current flows directly in one direction. In the circuit, current flows at a specific, constant voltage (this is oversimplified somewhat but good enough for our needs). using direct current. Most DC circuits are relatively low in voltage; for example, your car's battery is approximately 12volts,

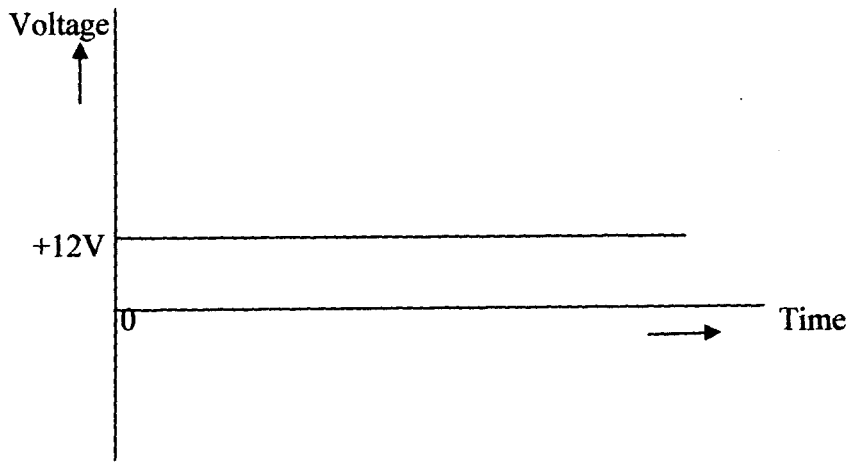


Fig3.1: An idealized 12volts DC. The voltage is considered positive because its potential is measured relative to ground or the zero potential-defaut state of the earth.

The power supply used for the construction of this car park aid circuit is direct current. The selection of the voltage used was based on the rating of the buzzer used. Here, 9volts battery was used, as it also worked effectively and efficiently with the 555 timer IC used.

3.3Transmitter Unit

The emanation of IC timers eliminated a wide range of electrical timing devices. It also helped in the generation of clock and oscillator circuits. Timing circuits are those, which will provide an output change after a predetermined time interval This is the action of the monostable multivibrator, which will give time delay after a fraction of a second to several minutes quite accurately.The most popular of the present IC, which is available in an eight pin dual inline package in both bipolar and CMOS form.The 555 timer is a relatively stable IC capable of being operated as an accurate bi-stable,monostable or astable multivibrator, The timer comprises of 23 transistors, 2 diodes and 16 resistors in its internal circuitry. Its functional diagram is shown in figure below

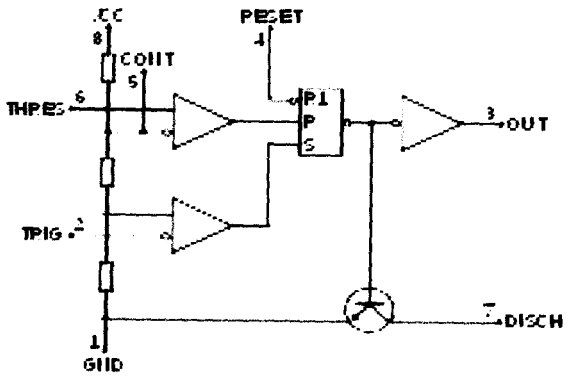


Fig 3.2Internal block diagram of 555 timer

The functional diagram consists of two comparators, a flip-flop, two control transistors and a high current output stage.The Two comparators are actually operational amplifiers that compare input voltage to internal reference voltage which are generated by internal voltage divider of three resistors. The reference voltages provided are one third and two

third of Vcc. When the input voltage to either of the comparators is higher than the reference voltage for the comparator, the amplifier goes to saturation and produces an output signal to trigger the flip-Flop. The output of the flip-flop controls the output stage of the timer- The 555 timer chip works from a D.C supply between 3-15V and can source or sink up to 200rnA at its output.

The operation of the 555 timers further define the functions of all pins- The details regarding connection to be made to pins are as follows.

Pin 1: This is ground pin and should be connected to the negative side of the power supply voltage.

Pin 2: This is the trigger input. A negative going voltage pulse applied to this pin when falling below 1/3 VCC causes the comparator output to change state. The output level then switches from LOW to HIGH. The trigger pulse must be of shorter duration than the time interval set by the external RC network otherwise the output remains high until trigger input is driven high again.

Pin 3: This is the output pin and is capable of sinking or sourcing a load requiring up 200mV and can drive TTL circuits. The output voltage available is approximately -1.7V

Pin 4: This is the rest pin and is used to reset the flip-flop that controls the state of output pin3. Reset is activated with a voltage level of between 0V and 0.4V and forces the output low regardless of the state of the other flip-flop inputs, if reset is not required, then pin 4 should be connected to same point as pin 8 to prevent resetting.

Pin 5:This is the control voltage input. A voltage applied to this pin allows the timing variations independently of the external timing network. Control voltage may be varied from between 45 to 90 of the Vcc value in monostable mode. In astable mode the

variation is from 1.7 to the full value of supply voltage. This pin is connected to the internal voltage divider so that the voltage measurement from here to ground should read 2/3 of the voltage applied to pin 8. If this pin is not used it should be bypassed to the ground, typically use a 10nF capacitor. This helps to maintain immunity from noise. The CMOS ICs for most applications will require the controlled voltage to be decoupled and it should be left unconnected.

Pin 6: This is the threshold input. It resets the flip-flop and hence drives the output low if the applied voltage rises above two-third if the voltage applied to pin 8. Additionally a current of minimum value 0.1 A must be supplied to this pin since this determines the maximum value of resistance that can be connected between the positive side of the supply and this pin. For a 15V supply the maximum value of resistance is 20M.

Pin 7: This is the discharge pin- It is connected to the collector of an npn transistor while the emitter is grounded. Thus the transistor is turned on and pin 7 is effectively grounded. Usually the external timing capacitor is connected between pin 7 and ground and is thus discharged when the transistor goes on.

Pin 8: This is the power supply pin and is connected to the positive of the supply. The voltage applied may vary from 4.5V to 15V although devices, which operate up to 18V. The transmitter unit which has an IC 555 timer and an infrared LED function in the astable mode.The astable mode of a 555 timer is discussed below.

3.4Modulated infra red transmitter(astable mode)

The popular application of 555 timer IC is an astable multivibrator which is designed to generate 730.5Hz output .The 730.5kHz directly modulates to provide an output that is sensed by infrared sensor

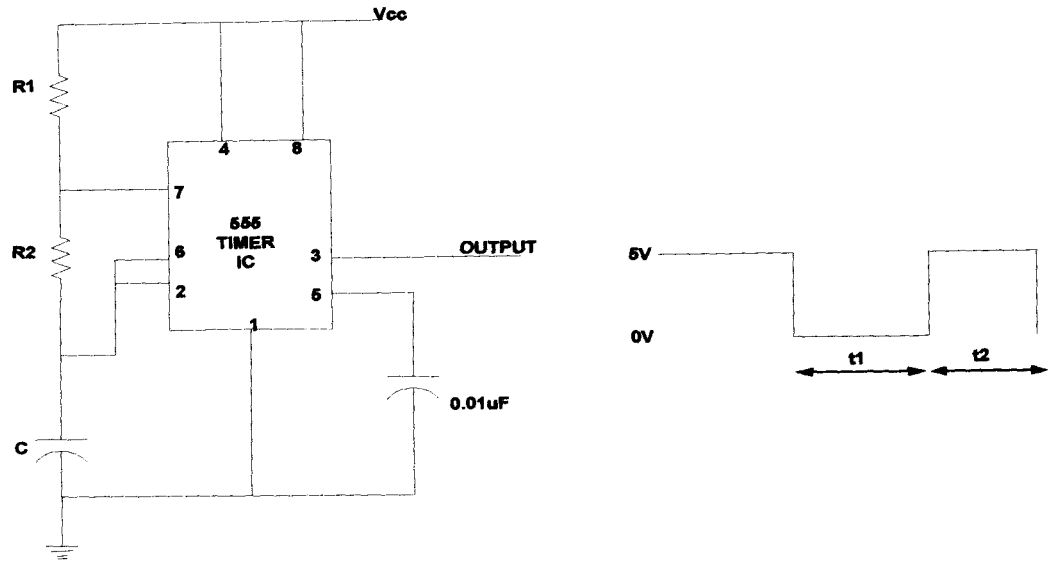


Fig 3.3 The IR transmitter is shown above

The 9 volts battery powers the transmitter. It consumes little power. a 555 timer shown in figure above was used to generate the signal and it was configured in astable mode .The threshold input pin6) six was connected to the trigger input pin (2) two.The external components $R_{1,}R_2 and C_1$ timing network that set the frequency of oscillation.

The timing capacitor charges through $R_{1,}R_2$ and discharges through $R_{1,}$.Thus,these two resistors precisely set the duty ratio.

In the astable mode of operation ,the capacitor charges and discharges between one third of Vcc and two third of Vcc.The charge and discharge time and frequency are independent of supply voltages.when the capacitor voltages reaches $\frac{1}{3}$of Vcc,the circuit switch to its LOW output state and when capacitor voltage reaches $\frac{2}{3}$of Vcc,it swiches to its output state. The charge time (output high) is given by

$t_1 = 0.693(R_{1+}R_2)C_1$

$=0.693\ (1000+\ 100{,}000)10\ X\ 10^{-9}=0.676ms$

And the discharge time (output) by

$t_2= 0.693R_2C_1$

$=0.693\ X\ 100\ X\ 10^3\ X10\ X\ 10^{-9}=0.693ms$

The total period is

$t = t_1 + t_2 = 0.693(R_1 + 2R_2) = 1.369ms$

In the astable mode, the frequency of the pulse stream depends on the values of $R_1, R_2\ and\ C_1$

Therefore,the signal generator frequency is $\frac{1}{1.369\times10-3} = 730.5HZ$

whereR_1, and R_2 are the values of the resistors in ohms and C is the value of the capacitor in farad. To achieve a duty cycle of less than 50% a diode can be added in parallel with R_2 towards the capacitor. This bypasses R_2 during the high part of the cycle so that the high interval depends only on R_1, and C1.

The resistor of R_2 was chosen to be one with very high resistance ,because a duty cycle approaching a minimum of 50% can only be achieved if $R_2>>R_1$, so that the charging and discharging times are approximately equal.Therefore R_2 was chosen to be 100kΩ and R_1, to be 1kΩ for this design.

3.5 Monostable multivibrator (receiver unit)

The 555 timer is also used as the receiver unit .It is a shot multivibrator when connected to the phototransistor i.e it senses only digital signal.It can either go HIGH or LOW.

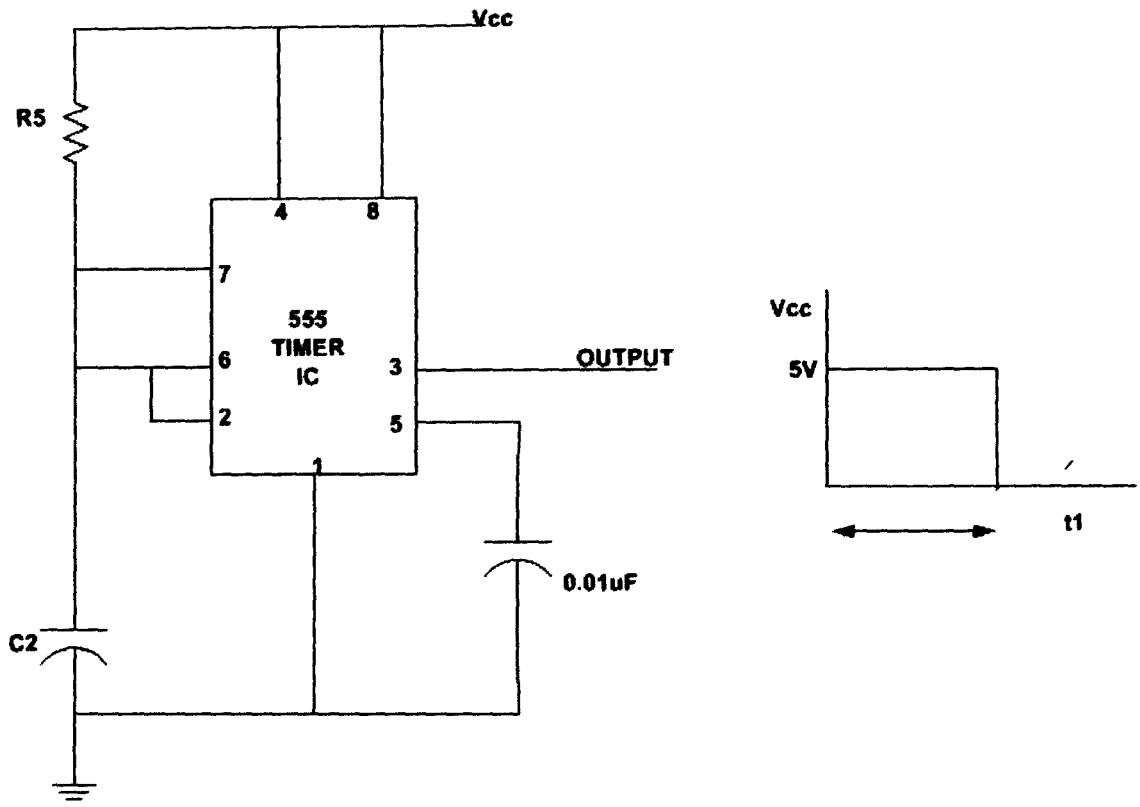


Fig 3.4 The receiver unit(monostable state)

When the trigger input goes negative ,it triggers the one shot with output at pin 3 then goes HIGH for a period given by the formula

$T_{high} = 1.1\ R_4C_2$

$=1.1\ X10\ X10^{3}\ X100\ X10^{-6}$

=1.1 sec

This is the time required for the receiver to respond to the signal sent by the infra –red (transmitter unit). The variable resistor is adjusted such that the frequency of the sensor(photo transistor) which is 38kHz is in consonance with the frequency of the infrared LED

In other to reflect signal from infrared to receiver, the frequencies of both the transmitter and the receiver must be in consonance otherwise ,the beam will be scattered and there will be poor or no reflection.

3.6 Output Unit

The output unit was made up of 6volts Buzzer and LED which were activated by the output of the IC2. The alarm was activated for about 1.1sec when cars is 25cm close to the wall

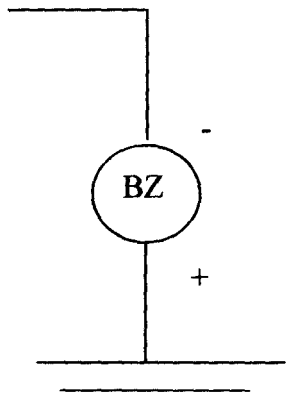


Fig3.5: Showing the connection of the Buzzer to the output of IC2 and the ground

3.7 PRINCIPLE OF OPERATION

The project simply utilizes the principle of infrared transmission and reception.Light is a form of energy radiated from a source.The infrared LED emit invisible e.m waves to the surface of the wall,the beam is reflected back as shown in the figure below.

The sensor(phototransistor) decodes this electrical signal and convert it to visible light energy with the aid of LED

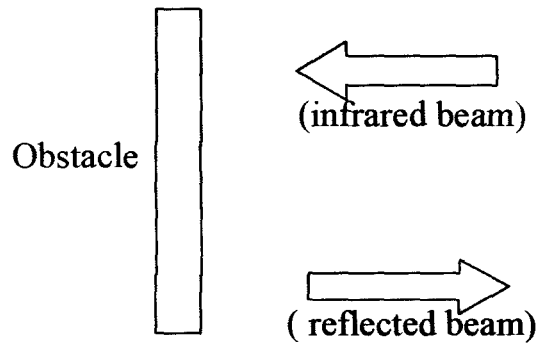
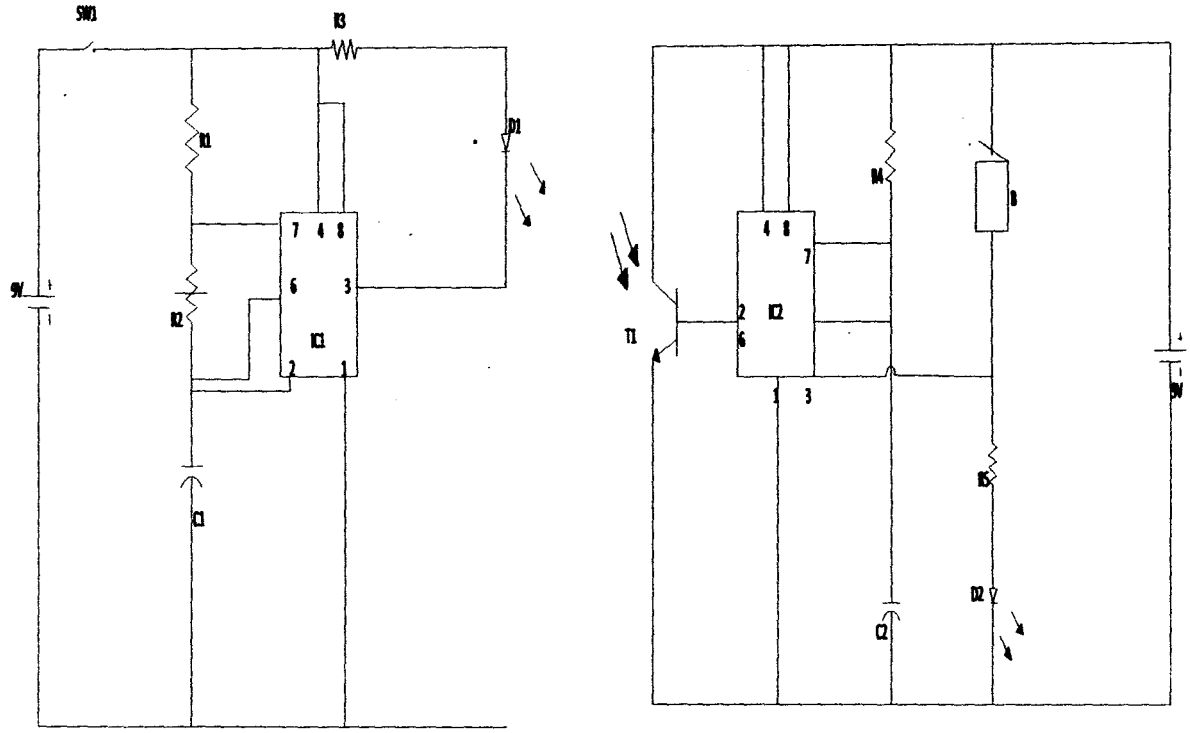
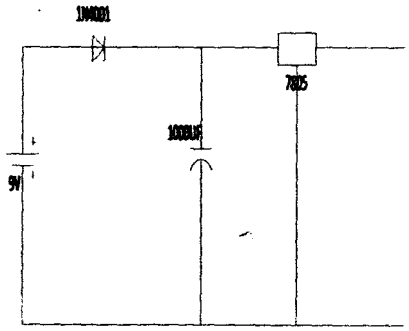


Fig 3.6 Diagram showing the reflection of infrared from the surface of the wall

CIRCUIT DIAGRAM

TRANSMITTER **RECEIVER**





POWER SUPPLY

Fig 3.7 Complete circuit diagram

COMPONENTS

1K-R_1
100K-R_2
100Ω-R_3
10K-R_4
330Ω-R_5
10nF-C_1
100μF-C_2
Infra-red LED-D_1
LED-D_2
Infra-red phototransistor-T_1
IC1,1C2--------555 Timer
IC3----------7805 regulator
B----------Buzzer

CHAPTER FOUR

CONSTRUCTION AND TESTING

4.1 Construction

The physical realization of the project is very important this is where ideas turn into reality the work is not just seen on paper but in reality. During the construction of this project all the components were first tested to confirm their values before use in the Construction. The output at each of the stages of both the power supply and the functional unit were tested. The testing process involved the use of some of the following equipment

DC supply: This was used to supply voltage to the various stages of the circuit during the breadboard test. This was used also used in the soldering process.

Digital multimeter; This is used basically for the measurement of voltage,resistance and current.

Capacitor Testing

After the ohmic range of the multimeter was selected the Probes were placed accordingly, based on the polarity of the meter and capacitor- An increase in the resistance value confirmed that the capacitor was in good condition. On the other hand if the value was constant, that would have indicated that the component was faulty.

Resistor Testing The multimeter was switched to the ohmic range and the probes of the meter were placed on each side of the resistors irrespective of the terminal. The resistance value of the resistor was read on the display.

For the construction the following tools were used:(a) Vero-board (b) Bread board (c)connecting wires (d) Set of screwdrivers (e) Soldering iron and lead (f)Lead sucker (g)Drilling machine

Each stage of the circuit was first carried out on a breadboard to check the practical workability of each stage. As soon as all was seen to be working, the whole work was then transferred on a $30cm \times 18cm$ vero board and tests were carried out on it. When it was discovered that the whole project was working in a good condition, everything was then cased.

Finally, the constructed work (receiver) was connected to dc mains and the transmitter was powered and when the distance between the receiver and the transmitter was approximately 25cm the LED was triggered ON.

4.2 PRECAUTIONS.

Proper and neat soldering was carried out to avoid unnecessary short circuiting on the board. Components soldered on the vero board were spaced from each other to avoid complications. The project was tested to determine its reliability and durability.

Table1.0 showing the readings of different distances for triggering of the LED

DISTANCE BETWEEN THE CAR AND THE WALL	STATE OF LIGHT EMMITTING DIODE(LED)
≤25cm	ON
≥25cm	OFF

Fig 4.1Diagram showing the constructed work

CHAPTER FIVE.

CONCLUSIONS AND RECOMMENDATION

5.0 Comments

After the testing stage it is clear that the objective of the project was achieved. With this device any person can park his or her car in the park lot without difficulty. The device also serves as a guide to the motorist. Although it can improved upon ,for instance, a larger LEDS should be used so that even those with eye defects can use the device efficiently and effectively

When functioning at its best, the LED should be able to come on when the transmitter is at a distance of 20cm from the receiver. It was also observed that the distance was affected by the strength of the battery which determine the intensity of the LED.

5.1 LIMITATIONS

It is observed that the device does not work effectively in an open environment, sunlight ray affect the parking aid device. It has been discovered that sunlight has infrared ray within it. Also the presence of reflective surfaces alters the distance and also brings about dark shadow. Thus this device will perform well in an environment that has less reflective surfaces, The device thus function effectively in an indoor arena.Moreover,the device is affected by external noise, a noiseless environment is suitable for this device.Another factor that affect the performance of the device is that LOS(line-of-sight) and the receiver must be able to see each other to communicate, it can therefore be used only for short range distance .

5.1 RECOMMENDATION. This project can further be improved upon by replacing the signal generator with RF(radio frequency) signal because it transmits signal at a longer distance than the signal generator(infrared).Also, the distance between the car and the wall can be improved upon, by using infrared of higher specification with better intensity capacity.

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