DESIGN AND CONSTRUCTION OF A DIGITAL HUMAN TRAFFIC MONITORING DEVICE

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DECLARATION

I Orugun Olakunle Abiodun declared that this project 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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DEDICATION

This project work is dedicated to the Author and the Finisher for his mercy towards me and my family, and to my late father Mr. T.O Orugun.

ACKNOWLEDGEMENT

My earnest gratitude goes to the alpha and omega for his love, guidance and protection throughout my course of studies.

My gratitude also goes to my parents, Late Mr. Orugun, and My Loving Mother, Mrs. A.S Orugun for their tireless support in the course of my study and also my brothers, Folorunsho, Jide and my sister Oluwafunmilayo for their support both morally and financially, to Solomon, Dammy, Richard, and the twins, a wonderful family like yours is hard to find.

To the Fawehinmi's family, thank you for your words of encouragement, especially to the most wonderful thing that has ever happened to me Fawehinmi Olamide; you give my life a meaning. I LOVE YOU.

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To my aunt, Mrs. Omowunmi James God will surely reward your labor of love towards my family, to my uncles, Mr. Yomi Orugun and Mr. Toyin Orugun thanks for being there.

To all members of the Kegite's club International (ilya komputa), thanks for entrusting me with the clubs money, may you all walk and never stumble.

My sincere gratitude goes to my supervisor Mr. zubair, for all the troubles you went through just to make this project work a thing of success, May Almighty ALLAH bless you and your family, Amen.

Finally, to everybody who has contributed to the success of my B.ENG program, I can't show all my appreciation here, but God will surely reward you all.

ABSTRACT

This project is designed to count and also to display the number of people entering a particular entrance and the number of those going out through the Exit. The system also displays the number of people remaining in the room.

The doors have opto-sensors such that an infrared beam is broken each time a person passes through the door and a signal is been sent to a digital control circuit which aids the counting. The design provides efficiency and adequate flexibility in the control of human traffic since it is electronically constructed.

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CHAPTER ONE

1.1 INTRODUCTION

Over the years the electrical and electronics engineering needs of digital counter have increased tremendously and from all indications the world is going digital, virtually every modern electronics equipments especially equipments which are digitally controlled or has digital numeric display are all made up of digital counter.

Technology is limitless, only imagination can govern its potential. During the horse and wagon days, traffic in big cities was heavy. The world first traffic light came into being before the automobile was in use, and traffic consisted of only pedestrians, wagons and horses. Traffic lights are expected to relieve congestion and also make our roads and streets safer for motorist, cyclist and pedestrians. Traffic lights save us travel time, with the increasing rate of vehicle users; traffic lights do become more essential to the community.

This project is design and construction of DIGITAL HUMAN TRAFFIC MONITORING SYSTEM (DHTMS). The system is designed to count and also to display the number of people entering a particular entrance and the number of those going out through the Exit. The system also displays the number of people remaining in the Room. The project involves the use of infrared break beam sensors, placed at the entrance and the Exit of the two door(s). A person entering through the door breaks the beam and a signal is sent to digital control circuits, which count and also display the count. Likewise, those going out of the room are also counted and displayed.

The applications of the system cannot be over emphasized. Apart from the counting of people entering and coming out of a particular place, the project could be modified and used to control an automatic slide doors usually used in banks, hotels, offices and conference halls etc it could also be interfaced to control a gate and trigger the opening when someone or a

car approaches. In this case people would think there is a security man even if there is nobody there opening the gate.

1.2 GENERALISED BLOCK DIAGRAM.

The operation of the circuit is summarized in the generalized block diagram below.

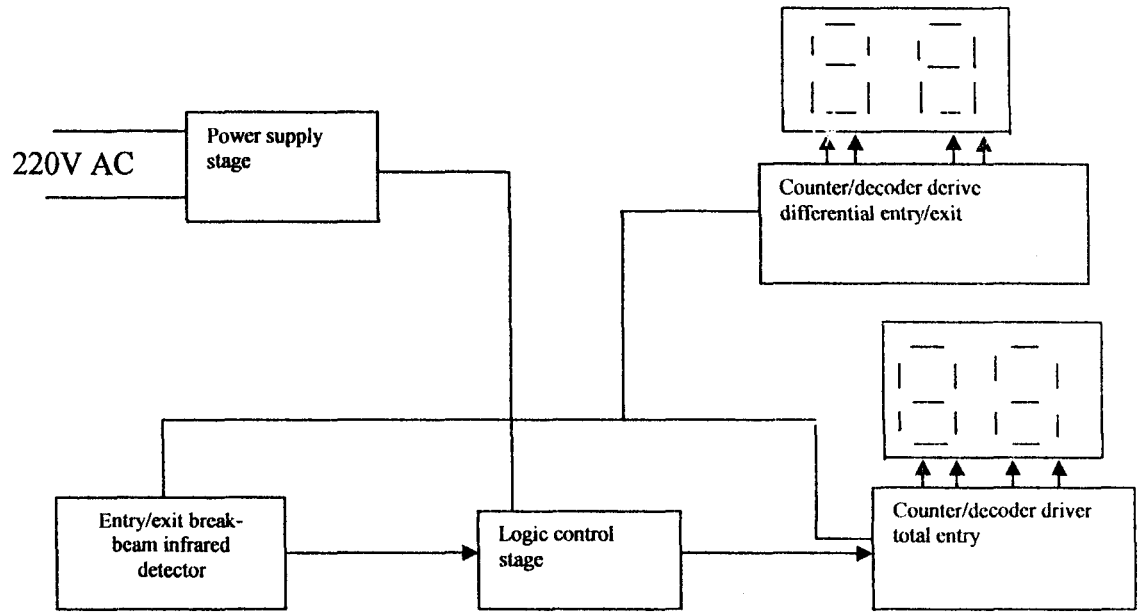


Fig 1.1 Block diagram of the system

1.3 OBJECTIVE.

The objective of this project work will thereby include;

1. To design and construct a simple low cost device that will aid the counting of people entering into a particular room, and people leaving through the exit, also the total number of people remaining in the room.
2. To ease up digital counting devices through the aid of infrared beam.
3. To create awareness in electrical and electronic design in digital counting devices.
4. To stimulate students interest in the growing field of digital counter.

5. To improve organization into and out of some restricted entrances, like the strong room of banks etc.

1.4 METHODOLOGY.

The method used in carrying out the project is as follows.

The project uses a power source, which is the regulated 5V from the main source (PHCN). This arrangement provides a steady power supply to the digital control circuit. The seven segment displays used are common anode and it starts counting up for entry when the output of the infrared receiver stage triggers a monostable multivibrator and when a person leaves the room an exit counter is triggered from an infrared sensor stage for exit. An independent counter is also configured to display the net count. (The total number of people left in the building.

1.5 SCOPE OF THE PROJECT

The DHTMS is based on sensors and a digital circuit; it also has a counter that counts the number of people entering into a building, the people going out through the exit door and the total number of people remaining in the building.

The major limitation of this project is that two people cannot be sensed at once, an error will be shown if it occurs, due to the fact that an infrared sensor can only sense one at a time.

1.6 PROJECT LAYOUT.

Chapter one

This chapter introduces the design and construction of the digital human traffic monitoring system, objectives, scope of the project and methodology.

Chapter two

This chapter begins with the historical and theoretical background of the project work.

Chapter three

This chapter contains the design, analysis and the calculations involving the design of the project work

Chapter four

The construction and testing of the entire work is reported in this chapter.

Chapter five

The final conclusion based on findings in the course of the work and the recommendations are included in this chapter.

CHAPTER TWO

LITERATURE REVIEW

2.1 HISTORY AND DEVELOPMENT OF COUNTING DEVICES

Improvements in digital counting technology are centred on and around electrical and electronics innovations. In early days counting were done in different ways mostly by manual. Man was the first counting machine that existed on earth, which involves counting with his fingers. Then as larger quantities emerged, various items such as twigs, pebbles, Napier's bones and abacus were used. [5]

The first counting equipment that existed was the abacus; this system is simply based on a radix of five. It has a set of beads moving on parallel strings, the first set contains five beads on each string which allows counting from 1 to 5, while the second set has 2 beads representing 5 to 10. The abacus emerged from the need for merchants to count and calculate prices and similar functions. The original counting boards were made of stone or wood, it has a grove between which beads or pebbles were moved. An example of a counting board is the salamis tablet which was discovered in 1846 on salami's island by the Babylonians. The salamis tablet is a white marble of length 149cm in length, 75cm in width and 4.5cm thick. [5] [6]

Napier's bone is another wonderful multiplication tool invented by john Napier of Scotland in 1550; the bones are a set of vertical rectangular rods, divided in 10 squares. The top square contains a digit and the remaining squares contain the first 9 multiples of the digit. When a number is constructed by arranging side by side the rods with the corresponding digit on the top, then its multiple can be obtained by reading the corresponding row of multiples from left to right while adding the digits found in the parallelograms formed by the diagonal lines.[5] [6]

Finally, the punched card which was invented by Herman Hollerith was used for vital statistics tabulation and was also adopted for use in the 1890 census. The punched card can be chosen as a basis for storing and processing information. The design of Herman Hollerith ruled the computing world for almost 100 years. [5] [6]

In our modern world today, Counting is something of necessity from human history after the development of language. Using a digital electronic counter in the area of monitoring human traffic hasn't been of greater use. But In several ways a digital electronic counter can be used.

A bank monitoring system: it is designed to give information on the number of persons entering and going out of the banking hall and also the total number of people remaining in the banking hall. It employs the use of up/down counter, which increases/decreases when a signal is been sent to an infrared sensor.

Another application is in a hall having 2 doors, one for entry and the other for exit, In this case, an infrared sensor placed both at the entry and exit and thereby number of persons that passes through the entry and exit door will be known.

Cinema Halls: design to give information on the number of persons within the hall during a film section, thereby number of persons that entered the hall will be known.

Also an automation room light controller, here once a person enters the room and the circuit registers a count. This enables the light while if that person leaves the room and the counters data is decreased, this causes the light to switch off.

Counting applications allows digital monitoring, numbering, recording and control of things, even people in the aspect of this project, more logic units are designed for counting operations with the invention and development of digital electronics that work on binary designation.

2.2 THEORETICAL BACKGROUND

Generally speaking, the project centres on how people can be counted as they make use of the monitoring system, to achieve this components ranging from simple resistor to integrated circuits, neatly arranged to give a count for each person coming in and going out of a particular room.

For a good understanding of the circuit to be discussed in the next chapter, there is the need to know the theory behind the various components used.

2.3 COUNTERS

Grouping of flip-flops together so that they act as a data store produces a register. Certain types of register can be used to count pulses and are known as counters. Flip-flops generally may be used to form counters but the JK flip-flop is the most popular and most flexible to use.

Counters generally are categorized to Asynchronous (ripple) and synchronous. They are made up of flip-flop, which are triggered sequentially (as in the case of Asynchronous counters) and simultaneously as in the case of synchronous counters. The simultaneous triggering of the ripple counter is useful in cases, which the propagation delay associated with ripple – through counter may be a problem. [2] [3] [6]

2.3.1 ASYNCHRONOUS COUNTERS

Consider the three-stage counter using JK flip-flops connected in toggle mode shown in Fig. 2.1 below.

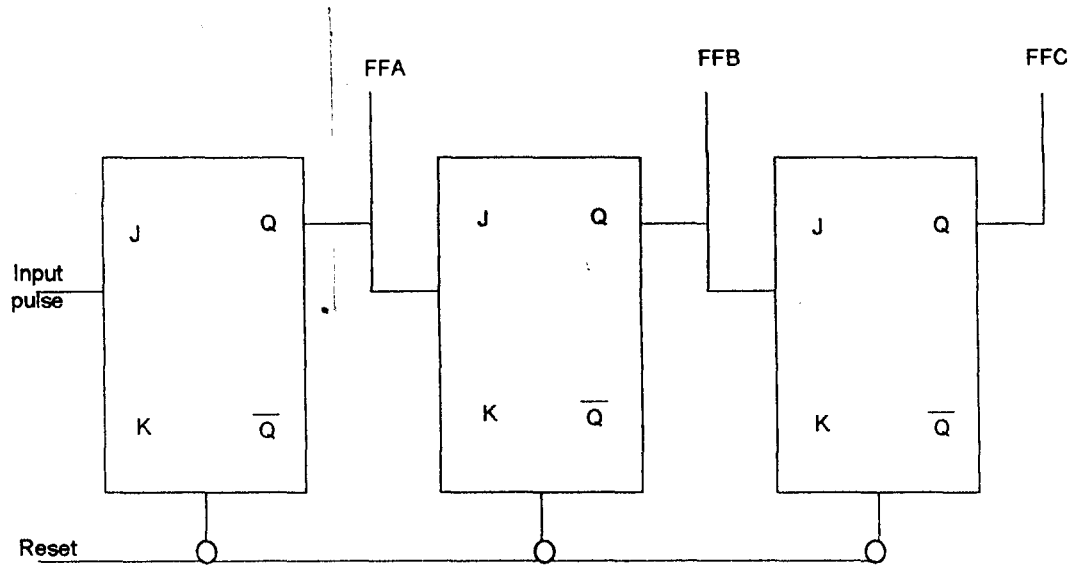


Fig 2.1 Three stage counter

If all outputs and initially reset to zero by an input going low in the clear line prior to the input signal arriving and the JK flip-flops are master-slave then the input pulse to flip-flop A (FFA) will have no effect on the QA output until the pulse changes from logic 1 to logic 0 level. However, the output QB reset at 0 since the input pulse to flip-flop B (FFB) has gone from 0 to 1. Similarly, QC will remain at 0.

When the second input pulse has arrived and gone from logic 1 to logic 0. However, this is a negative transition and as such will cause the output of (FFB) to toggle so that QB goes to 1. Since this is a positive transition QC will be unaffected and remains at 0.

At the end of the third input pulse, QA again toggles; this time to logic1 QB and QC retain their values of 1 and 0 respectively. At the end of the fourth input pulse, QA toggles and falls to 0. The transition from 1 to 0 at the input to FFB causes QB to fall to 0 and this transition in turn causes FFC to toggle so that QC goes to 1. [2] [3] [6]

A commercially available counter is the 7490. This circuit is internally divided into two sections giving a ÷2 and a ÷5 representation. The IC pin is shown in fig 2.2.

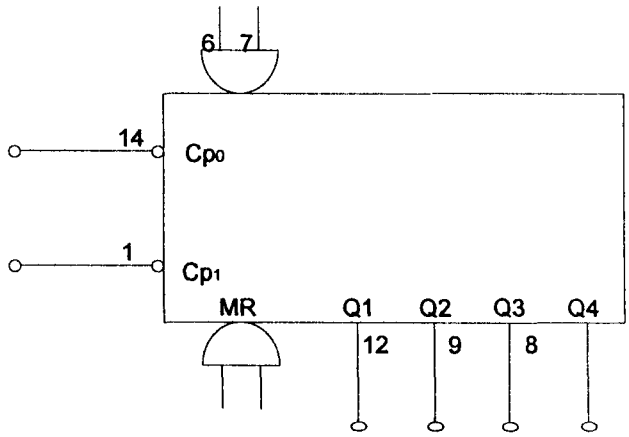


Fig 2.2 7490 Decade counter

The 7490 counter when used as BCD counter or an equivalent decade counter could be cascaded to give larger decimal counts. Suppose it is required to build a counter to count from 00 to 99 before units being used to clock the next count, which represents tents. The QD output of the tents counter would likewise be used to trigger the 7490 to be used to count tens. [2] [3] [6]

2.4 DECODER DRIVERS / DISPLAY

The output of a counter may be required to feed some kind of numeric display to enable the figures to be seen. The decoder gets the data from the counter (in BCB code) and converts it to a code acceptable by the display in order for the display to show the counted figure. The decoder contains à driver inside it (usually made up of transistors), which ensures that the decoder output can safely handle the amount of current required to flow through the LEDs (Light emitting diodes) in the display module.

A four bit binary number is applied to the inputs of the display driver. Considering the CMOS 4511 decoder/driver IC supplying a common anode LED display. As an example of the decoding action, suppose D =0, C = 0, B = 1 and A = 1, the BCB input is 0011 (3 in decimal) and the outputs a, b, c, d, g, needed to light five LED segments making a "3" all go high. If the BCB number exceeds 9, all outputs go "low" and the LED display in blank.

Normally LT (limp test) is kept high, if it is low it is active and all the outputs go high and test the display by lighting every segment, no matter what the inputs are. BL (blanking) is also usually held high, but if it is goes low, (and LT is high), all outputs go low and blank out the display. When LE (Latch enable) is low, the seven outputs follow the input changes if LE is high, the last input is stored or "latched" and held on display. Fig. 2.3 shows the connection of the 7447-decoder/ drivers, to a display. [2] [3] [4] [6]

s

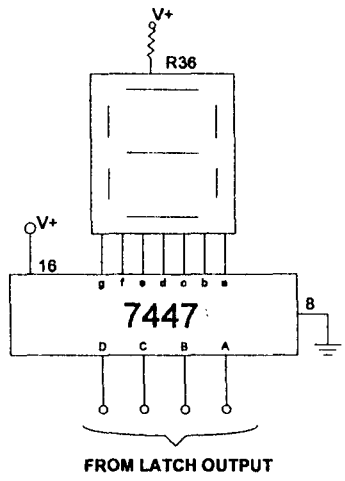


Fig. 2.3 Decoder/Driver stage

2.5 IC TIMERS.

The emanation of IC timers eliminated a wide range of mechanical and electromechanical 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, of course, the action of the monostable multi-vibrator, 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 in line package in both bipolar and CMOS form. The 555 timers is a relatively stable IC capable of being operated as an accurate bistable, monostable or astable multivibrators. The timer comprises of 23 transistors, 2diodes and 16 resistors in its internal circuitry. Its functional diagram is shown below in Fig 2.4

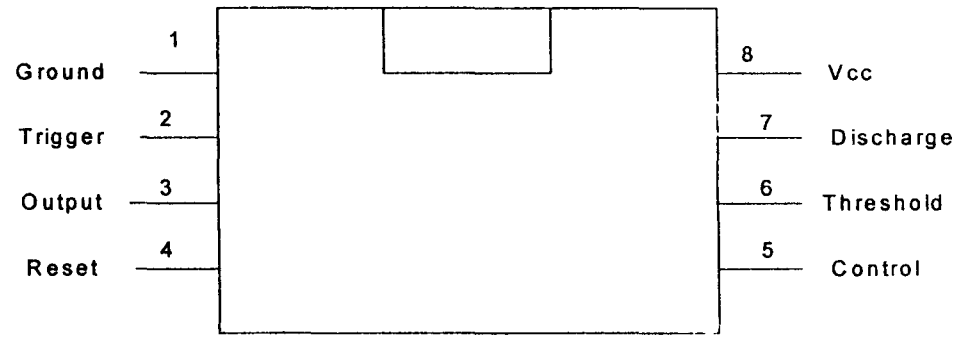


Fig 2.4 555 timer pin orientations

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 200mA at its output. The operation of the 555 timers is further defining the functions of all the pins. The details regarding connection to be made to pins are as follows.

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

Pin 2: This is the trigger input. A negative going voltage pulse applied to this pin when falling below 1/3Vcc 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 CR network other wise 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 to 200mV and can drive TTL circuits. The output voltage available is approximately –1.7V.

Pin 4: This is the reset pin and is used to reset the flip-flop that controls the state of output pin 3. 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 accidental 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.

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 of the voltage applied to pin 8.

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, pin 7 is effectively grounded.

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 16V although devices, which operate up to 18V, are available. [2] [3]

2.6 OPTO-DEVICES

Opto-devices convert light energy from one form to another. They are used for transmission of infrared rays, emission of light in different colors (i.e. LED's), sensing of light rays of different intensity (LDRs, photo diodes and phototransistors), and for the conversion of light to different electrical quantities like current voltage and frequency. The various opto-devices are reviewed below.

2.6.1 INFRARED EMMITER (LED)

A LED (generally) is a junction diode made from the semi-conductor material, gallium arsenide phosphide. Its action and the type of ray it is dependent on the type of semi-conductor doping used. The infrared type when furnished with appropriate voltage and current (which could be gotten from data sheets), emits infrared ray at a given wavelength.

Typically the 5mn LED emits infrared current of about 150mA at a voltage of about 1.7v.d.c forward current. The symbol for the infrared emitter is shown in fig 2.5 below.

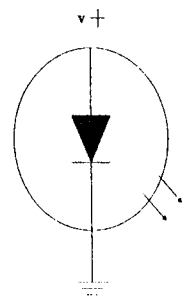


Fig 2.5 Infrared emitting diode.

2.6.2 THE PHOTO –DIODE

The photo diode consists of a normal P – N junction with a transparent window through which light can enter. A photodiode is usually operated in reverse bias and leakage current increases in proportion to the amount of light falling on the junction. This effect is due to the semiconductor and producing electrons and holes. Photo diodes find application in counter circuits, scanners for discs remote control receivers etc. [1] [4].

The schematic symbol is shown in Fig 2.6 below.

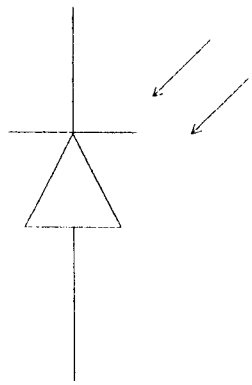


Fig 2.6 Schematic symbol for photo diode

CHAPTER THREE

DESIGN AND ANALYSIS

3.1 PRINCIPLE OF OPERATION

The opto-sensor, sense the people entering or tearing the building. Three displays are used for the monitoring of ***ENTRY, EXIT*** and ***ENTRY / EXIT.*** The doors have opto-sensors such that an infrared beam is broken each time a person passes through the door. The output of the infrared receiver stage triggers a monostable multi-vibrator, which clocks the counter to count-up for ***ENTRY.*** If somebody leaves the building, the ***EXIT*** counter is triggered from an infrared sensor stage for ***EXIT*** and the counter updates the ***EXIT*** count. An independent counter is configured to count UP/ DOWN to monitor both the Entry and Exit.

This counter will display the ***NET*** count, which is the number of people still left inside a particular building or house.

The three displays are assumed to be monitored independently so that a consonance of results can tell that there is no cheating in any way, especially for a security system or in occasions where gate takings are made and tickets are sold.

3.2 ENTRY / EXIT SENSOR STAGE

The entry/ exit sensor stage is comprised of an infrared transmitter and receiver stage. The transmitter uses an infrared diode, while the receiver uses a photo diode and an amplifier circuit to form the infrared detector stage.

3.3 TRANSMITTER STAGE.

The transmitter stage is not designed to be too complex since no signal coding is involved. The infrared diode is forward biased to meet the electrical condition and specifications with which it operates. The transmitter stage is as shown in fig 3.1a below.

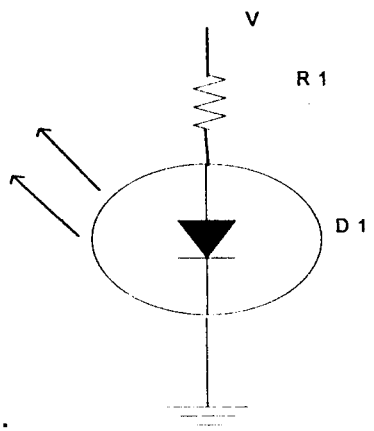


Fig 3.1 the transmitter stage.

D_1 is the opto device (infrared diode) while R_1 the limiting resistor.

V+ is gotten from the power supply(i.e 5V).

For the diode to be forward biased,

$V_F = 1.7V$ (V_F = max forward voltage)

$I_F = 150mA$ (I_F = max forward current).

The resistor R will therefore be,

$$R = \frac{V+ (- V_F)}{I_F} \qquad \text{---------- (1)}$$

R= (5 - 1.7)/ 150mA

= 22Ω.

Once forward biased the transmitter emits infrared rays projected towards toe receiver from one end of the door to another.

3.4 INFRARED RECIEVER STAGE.

The receiver stage is shown in Fig 3.2 below. The circuit employs the use of a photodiode receiver and amplifiers to enable its output drive other stages. The photo diode was used as the main opto-sensor due to its ability to resist day light interference better than the other optical devices mentioned. The photodiode is operated in reverse biased condition. In darkness the photodiode has a high reverse resistance. The change in resistance causes a change in the drop across the photo diode Dx. which is fed to the input of the comparator IC1. The resistance measured from the photodiode when there is no transmission of infrared is approximately 1MΩ and during transmission drops to approximately 5K. Fig 3.1c shows the infrared transceiver circuit and the monostable stage IC2 is a Schmitt trigger stage to remove ripple noise from triggering the counter falsely.

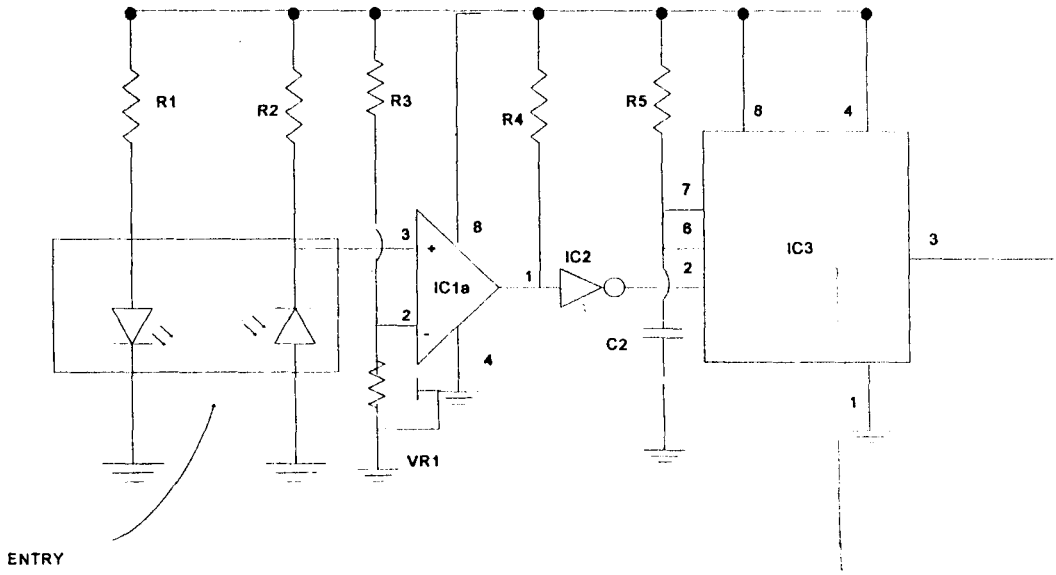


Fig 3.2 Infrared receiver stage.

The photo diode gives different resistances for light (i.e. reception of infrared light) and darkness (i.e. when there is no reception of infrared light). This change in resistance will show as voltage change when connected with a resistor which forms a potential divider with it. The resistance of the photo – diode (R_D) was found to be as follow.

Darkness (i.e. no transmission) ---------- ($\simeq 1M\Omega$)

Light (i.e. transmission) ---------- ($\simeq 5K\Omega$)

Considering that for these two situations there would be a drop (V_{RD}), across the photo diode R_D.

Since $V_{RD} = RD/(RD+R_2)*V$ ---------- (2)

Where RD = drop across diode

V_{R2} = voltage drop across R2.

V+ = 5v supply.

Now setting the voltage across R2 to be 2.5V in darkness (i.e. without any infrared rays)

Then $2.5V = \frac{R_2 \times V+}{1M\Omega + R_2}$

$$0.5 = \frac{R_2}{1M\Omega + R_2}$$

$$0.5M\Omega + 0.5R_2 = R_2$$

$$R_2 = \frac{0.5M}{0.5}$$

$$= 1M\Omega$$

This implies that upon transmission, the drop across will be

$$V_{R2} = [R_2/(5k + R_2)] * 12 \quad \text{---------- (3)}$$

= 1MΩ/1.005MΩ *12

= 4.9V

Hence R1= 22Ω, and R2=1MΩ R3 and R4 form a potential divider to set the reference voltage for the comparator. R3=1K and R4= 5k preset.

Connecting this to comparator with a reference in between the two voltage levels of darkness and light will give two distinct outputs (i.e. "HIGH" or "LOW") for transmission and NO transmission respectively.

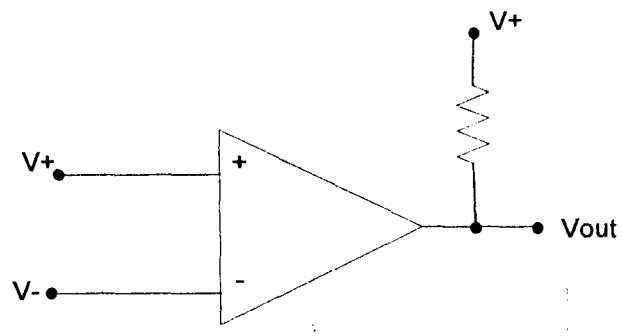


Fig 3.3 Comparator.

$V_{out} = V_{in} X A_o$ ---------- (4)

Where $V_{in} = V^+ - V^-$

And A_o = open loop gain.

Since open loop gain is always very large (in the order of 20,000), any positive difference will make the output "1" (in this case 5V), and any negative difference, "0" . Now for this design if the reference is set at 3.5V then upon transmission Vout will be high and low upon reception, which will bring the required clock output pulse.

3.5 MONOSTABLE STAGE.

The monostable stage generates a one shot pulse once triggered from the comparator. The one shot pulse is required as the input to the counter is edge triggered. The time duration of the monostable is approximately 1s. it is assumed that the rate at which people will enter the door and exit will not be more than 1s. fig 3.1c shows the monostble and transceiver stages. IC3 is the monostable timer IC and forms the monostable stage.

DESIGN CALCULATOINS.

The time constant (T) =1.1 RC.

R = 1/1.1C (letting C= 100μF).

= 1/1.1 X 100uF.

= 9.09K

= 10K preferred value.

3.6 COUNTER STAGE

The counter stage uses a 74190-up/down decade counter. The choice of the counter is basically because it can count up and down, and this is required in the design for the net count to be gotten in one display. The counter circuit is shown in fig 3.4 below.

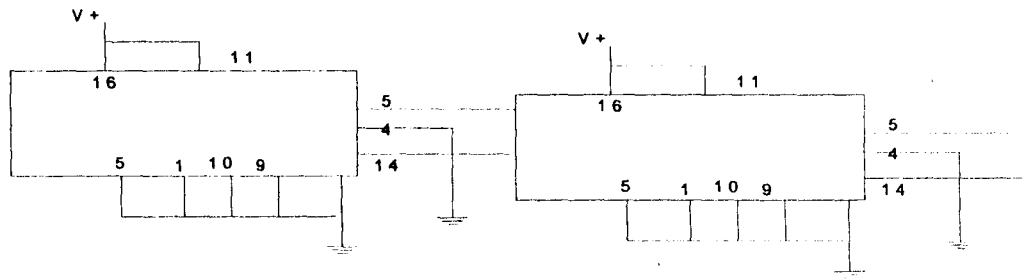


Fig 3.4. Counter circuit

The counter contains four master slave flip flops with internal gating and steering logic to provide asynchronous present and synchronous count-up and countdown operations. Asynchronous parallel load capability permits the counter to be present to any desired number. Information present on the parallel data inputs (D0- D3) is loaded into the counter and appears on the outputs when the parallel load (PL) input is LOW.

The operation of the 74190 is summarized on the truth table below.

OPERATING MODE	INPUTS					OUTPUTS
	PL	U/D	CE	CP	Dn	Qn
Parallel load	L L	X X	X X	X X	L H	L H
Count up	H	L	1	1	X	Count up
Count down	H	H	1	1	X	Count down
Hold "do nothing"	H	X	H	X	X	No change

Table 3.1 7490 Truth table

3.7 DECODER/DRIVER/DISPLY STAGE.

The 7447 is 7 – segment decoder which accepts a 4 – bit BCD and produces the appropriate outputs for selection of segments in a 7 – segment displaying arrangement used for representing the decimal numbers 0 to 9. The outputs (a, b, c, d, e, f, and g) of the decoder select the corresponding segments as shown in Fig.3.5.

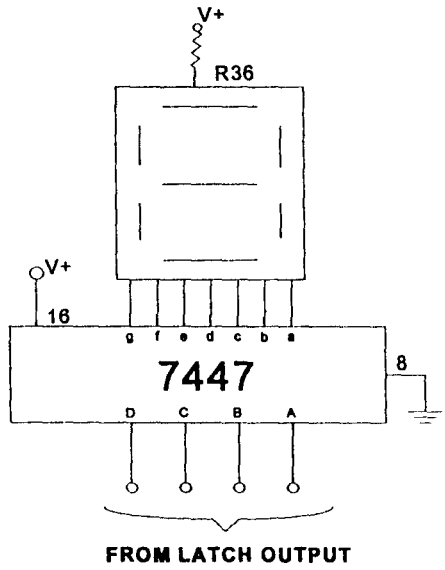


Fig 3.5 Seven segment digital display

The value of the limiting resistor R_8 is calculated is shown below. The display has the following specifications,

Max. Forward current (Ifs) = 16mA

Voltage drop across each LED V_{LED} = 1.7V

And $V^+ = 5V$

$$V^+ = IF\ R_{36} + VLED \qquad \text{---------- (5)}$$

$$R_8 = \frac{V^+ - VLED}{I_F} \qquad \text{---------- (6)}$$

$= 5 - 1.7 / 16mA$

$= \frac{3.3}{16mA}$

$= 206.25\Omega.$

3.8 POWER SUPPLY STAGE

All stages in the project use +5V.The power supply stage is a linear power supply type and involves in step down transformer, filter capacitor, and voltage regulators. To give the various voltage levels. The power supply circuit diagram is shown in fig. 3.3

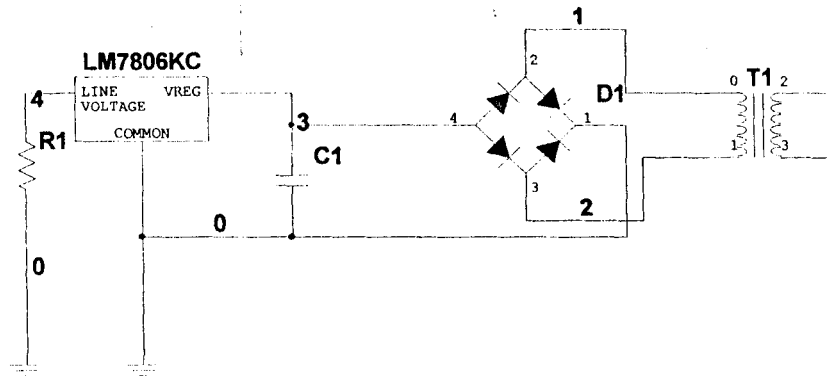


Fig 3.6 Power supply circuit

The rectifier is designed with four diodes to form a full wave bridge network. C_1 is the filter capacitor and C_1 is inversely proportional to the ripple gradient of the power supply. Fig. 3.7 shows the ripple gradient

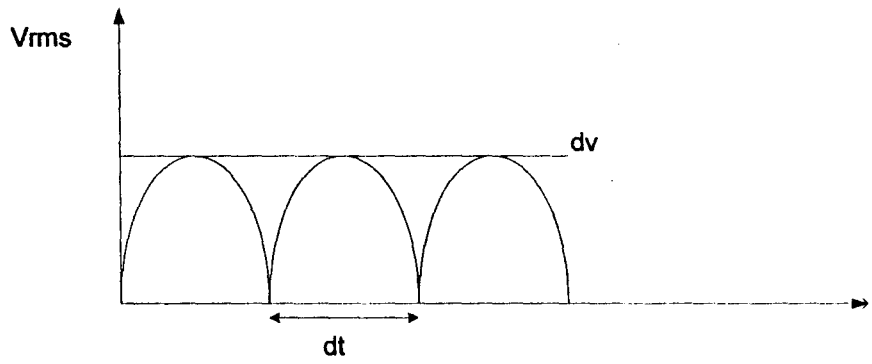


Fig 3.7 Ripple gradient

Where dv is the ripple voltage for time dt, where dt is a dependent in power supply frequency.

For an rms voltage of 5volts (from power source)

Vpeak = 5 x √2 (i.e., rms x √2

= 7.071V

Hence letting a ripple voltage of 15% makes dv = 1.06

But $1/C = \frac{dv}{dt}$ ---------- (7)

$C = \frac{dt}{dv}$ ---------- (8)

$= \frac{10ms}{1.06V}$ (where dt = 10ms for 50Hz)

$= 943.9\mu F$

A preferred value of 1000μF was employed for the power supply stage. A 7806 Regulator was used. The transistor TIP41 used to buffer the output drops 0.7V (V_{BE}) to reduce the +6 to 5.3V, which is approx. +5V.

CHAPTER FOUR

CONSTRUCTION, TESTING AND DISCUSSION OF RESULTS.

4.1 CIRCUIT CONSTRUCTION

The construction technique of any project has to do with the proper knowledge of the design steps; it involves the interfacing of various electronic components to work in accordance with the circuit diagram. The construction of the project work was done in two different stages namely:

1. The soldering of the circuit to the board
2. The coupling of the entire project to the casing

The implementation of this project was first done on the breadboard. The power supply unit was done with great care; it was derived from a bench power supply which supplied voltage to the various stages of the circuit.

The counter and receiver stages were constructed and tested on the bread board according to the block representation, before soldering of circuit commenced on the Vero board. The various stages and circuit were soldered in tandem to meet the desired workability of the project.

The first Vero board contains the power supply unit, receiver circuit and the two clock generating circuits and the second contains the decade counter, decoder and the up/down counter stages.

4.2 CASING CONSTRUCTION

The second phase of the project construction is the casing of the project work. The project was coupled to a plastic casing, the casing material was designed with special perforation and vents to ensure insulation and give ecstatic value.

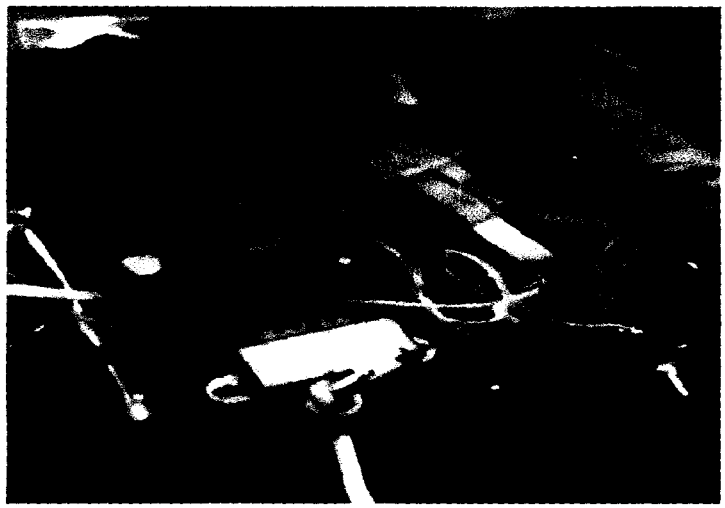
4.3 TESTING

After carrying out all the necessary paper design and analysis, the project was implemented and tested to ensure it's working ability, and was finally constructed to meet the desired specifications. The process of testing and implementation involved the use of some test and measuring equipments stated below.

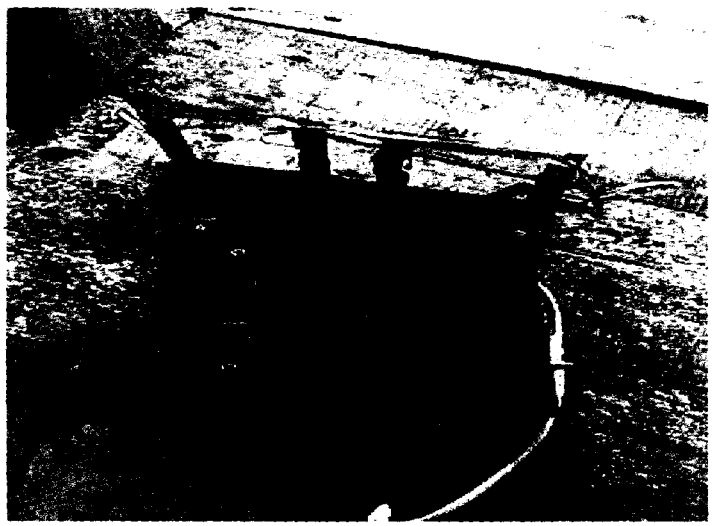
1. **BENCH POWER SUPPLY**: This was used to supply voltage to the various stages of the circuit during the breadboard test before the power supply in the project was soldered.
2. **OSCILLLOSCOPE**: The oscilloscope was used to observe the ripples in the power supply waveform and also to observe the pulse generated at the monostable multivibrator circuit.
3. **DIGITAL MULTIMETER**: The digital multimeter basically measures voltage, resistance, continuity, current, frequency, and temperature. The process of implementation on the board required the measurement of parameters like the voltage, continuity, current and resistance values of the components. The multimeter was also used to check the voltage level of the ray of light that was transmitted using the infrared in this project.

4.4 RESULT

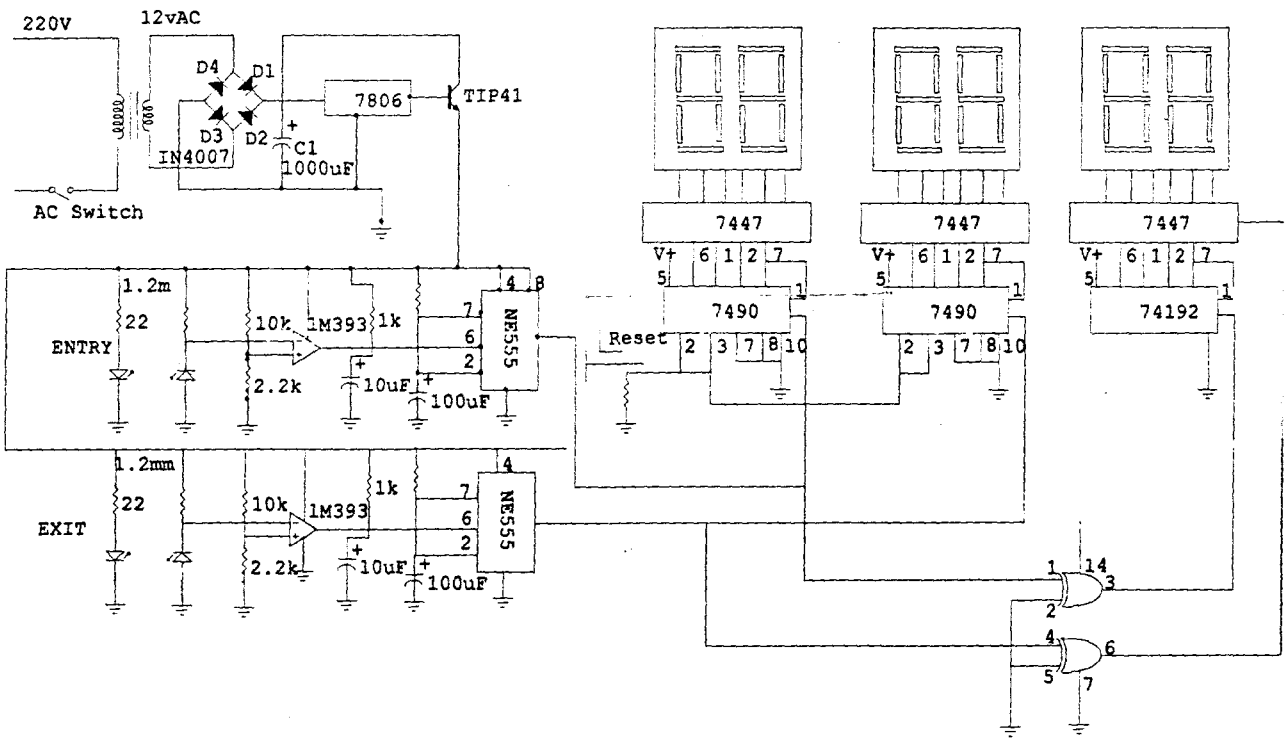
The results obtained from the design shows that the design was able to detect the presence of a person breaking the infrared beam either on entry or exit from the room. The display counts up when someone passes through the entry door and the second counter starts counting down when someone passes through the exit door, a third counter was designed to show the number of people still remaining in the room.



APPENDIX 1



APPENDIX 2



Comprehensive Circuit Diagram of the system

APPENDIX 3