DESIGN AND CONSTRUCTION OF ELECTRONIC COMBINATION LOCK SYSTEM TO START A VEHICLE IGNITION.

BY

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DECLARATION

I hereby declare that this project is an original concept wholly carried out by me, under the supervision of Engr. MUSA D. ABDULLAHI of the department of Electrical and Computer Engineering, Federal University of Technology, Minna.

.... 3/11/03

Engr. M. D. Abdullahi Date

DEDICATION

This project work is dedicated to the Lord Jesus Christ whom I have been receiving favour and mercies from my heavenly father, GOD Almighty in the course of this project.

CERTIFICATION

This is to certify this project title "Design And Construction Of Electronic Combination Lock System To Start A Vehicle Ignition" is carried out by Anthony Iwotor Jnr under the supervision of Engr. M. D. Abdullahi and submitted to Electrical and Computer Engineering Department, Federal University of Technology, Minna in partial fulfillment of the requirement for the award of Bachelor of Engineering (B. Engr.) degree in Electrical and Computer Engineering.

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External Examiner

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Date

／ACKNOWLEDGEMENT

My gratitude goes to my parents, Chief & Mrs. Tony Iwotor for their love, support and encouragement through the course of my studies and project, I say thank you and God bless.

Worthy of note is the immense technical contribution of my supervisor Engr. Musa D. Abdullahi, Msc (Engr.), FA Engr., FIEE, FNSC. Who always guide me in the event of my project.

Further more, I am grateful to my brother and sisters Nnamdi, Nene and Jennifer for their love and encouragement through the course of my studies.

Finally to all my friends, both at home and in school, I thank you all for your help and co-operation.

ABSTRACT

The purpose of this project is ensuring adequate security to vehicles/cars from been theft, simply by means of an Electronic Combinations Lock in which only the selected code known to the user of such car/vehicle will energise the Ignition system. This is usually accomplished with the aid of a counter bounce switches which are meant to input the selected code and hence energise the load (Ignition system) via the switching circuit comprising of a relay and a transistor.

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CHAPTER ONE

1.0 INTRODUCTION.

For the goal of every nation is to develop into a must prosperous society, having attain tremendous increase in the provision of food, shelter, housing, transport and technology. Its security must be of paramount interest. Of course technology is the tool that make the preservation and the totality of human socio- economic possible, but it's security must be giving the topmost priority it deserve if any nation must under go developmental process. For instant, consider the automobile industry primarily establish on the platform of boosting car production, enhancement of security to it's product has been of a great concern to the Electrical Engineer. In enhancing the security to the automobile products, a Digital Electronic Combination Lock For Vehicle (car) was design and constructed. This devise was constructed with an encoder (they board) meant to send input signal (selected code) through an IDE (Integrated Digital Electronics) cable to a clocking circuit which in turn drives a decoder and a switching circuit comprising of a relay and a transistor (2N2222). The decoder decode the incoming signal (binary digit) 1 or 0 digit from the clocking circuit comprising Schmitt trigger and a D-latch and subsequently drives the seven-segment display to indicate the selected code. Meanwhile, the switching circuit drives the load (ignition system of the car vehicle) through the relay whose coil is energized by the transistor collector output.

1.1 LITERATURE REVIEW.

Until the seventeenth century, London has no organization which ensured the security of its property and its inhabitants against crime. Only then were 1000 watchmen recruited, each was paid less than shilling a night. Those watchmen who are know as "charlies" after king Charles II, were usually completely unsuitable for their duties, both physically and mentally, if Henry Fielding, the magistrate and author is to be believe. It was not until Sir Robert Peel was appointed home security in 1822 that further action was taken to prevent crime. After six years in office he manage to convince a house of common committee to recommend the formation of police force. The metropolitant police bill was passed in 1829 but it was out until 1856 that the whole of the country had a police force. The initial purpose of the police was the prevention of crime rather than detection of an offender, but this latter duty soon became a major occupation and the problem of preventing and protection was only partly solved.

In 1883, George Lush Peanson applied for a patent for his invention which "would alarm" by means of electronics communication. This was initially a revolving lamp on the exterior of the protected premises or the use of bells. It was not, however, until about 1923 that the intruders alarm become generally available. Since that time equipment has been design which uses the principle of ultrasonic, microwave, infra-red light, television, current monitored wiring, magnetic recorders, pressure pads, vibration sensor, heat sensor, capacity sensors, microphone and electronics security system.

1.2 PROJECT MOTIVATION/OBJECTIVES.

The analysis of the aim and objectives of this project: Design and Construction of Electronic Combination Lock for Vehicle Ignition System are;

(i) To develop a simple low cost device aimed at easing the prevailing the financial difficulty face by vehicle/car owners in the security of their cars.

(ii) To stimulate interest of upcoming students to take-up research topic, not only in electrical and computer engineering, but also extending their aim of research to other field, say, automobile industry, the car/vehicle security in particular, there by demonstrating the versatility of Electrical & Computer Engineering as a discipline of great generousity.

1.3 PROJECT LAYOUT/OUTLINE:

Chapters one introduces the project and review some of the related work done by people.

Chapter two present the detailed design/calculation of the Electronic Combination Lock System incorporating a power supply unit, encoder, clocking circuit, switching circuit (comprising a relay $12V_{dc}$ and a transistor PNP 2N2222) as well as a display unit comprising a decoder and a seven-segment display.

Chapter three is strictly concern with the construction and testing of the project work. Also various equipment and components used in the construction of the hardware is included.

Chapter four discusses the result obtained and recommends ways o improve on the design. Inclusively, it also contains the final conclusion based on my research work.

CHAPTER TWO

2.0 INTRODUCTION

The advent of the modern days security system has produce productivity, time reduction and technological enhancement to the automobile industry.

This chapter gives the complete description of the various elements or modules used in the design and construction of "Electronic Combination Lock System To Start Vehicle Ignition". The theoretical background of each elements is extensively dealt with.

The block diagram of the electronic combination lock system circuit is shown below,

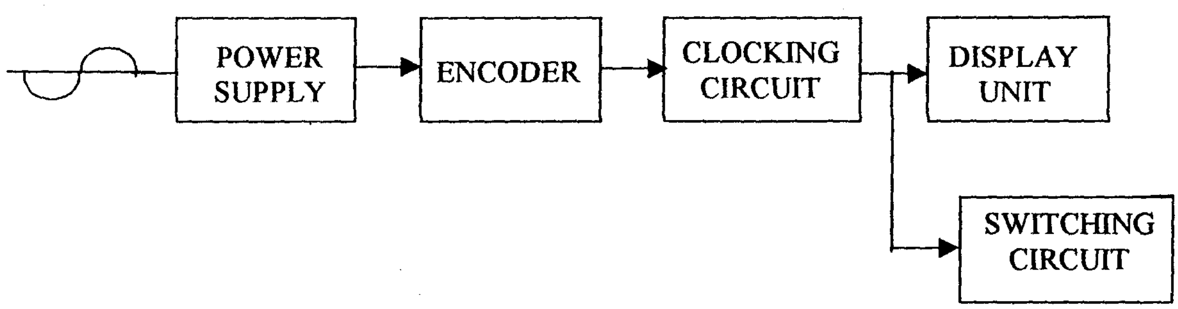


Fig. 2.0 Block diagram of an electronic combination lock system for vehicle ignition.

2.1 THE POWER SUPPLY

Majority of electronic circuit uses direct current supply obtain by rectifying the a.c. Voltage from NEPA. This is achieved through the following laid down procedures. The block diagram to illustrate this is shown below.

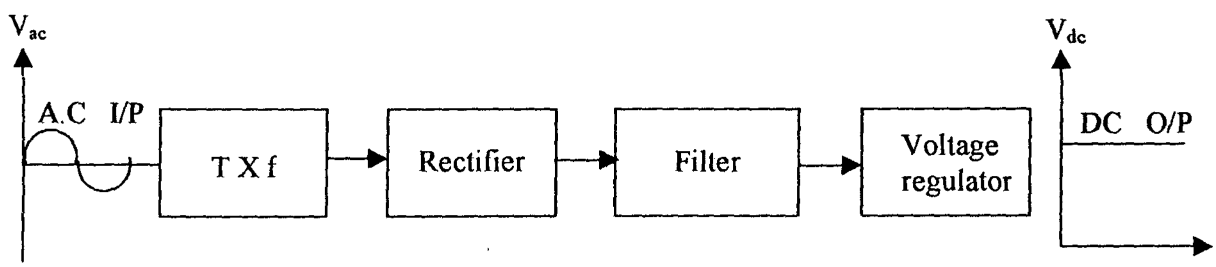


Fig. 2.1 A block diagram showing the stages of a regulated power supply.

2.1.1 TRANSFORMER

a 240V (r.m.s) /12V (r.m.s) step down transformer was used to reduce the 240Vac from the NEPA supply to 12Vac which is rectified to give the required d.c voltage.

2.1.2 RECTIFICATION

The term rectification is defined as the process of changing or converting a pulsating A.C voltage into D.C voltage by eliminating the negative half circle of the alternating voltage. This project adopts the use of a full-wave bridge rectifier because of its ability to produce the approximate varying and reference voltage. The maximum instantaneous voltage between terminals is;

$$V_{max} = V_{r.m.s}\sqrt{2}$$

The four diodes in the fig.2.1.2 are arranged in a diamond configuration called the full-wave bridge rectifier.

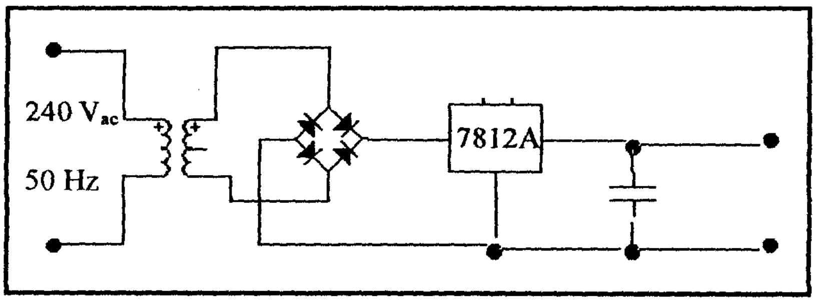


Fig 2.1.2 Rectification circuit

CALCULATION.

A direct current voltage (V_{dc}) is given below by:

$$V_{dc} = \frac{2V_{max}}{\Pi} = 0.636V_{max}$$

But the PIV (Peak Inverse Voltage) should be greater than V_{max}

Note also, $V_{r.m.s} = 12V$

and $V_{max} = \sqrt{2}\, V_{r.m.s} = 12\sqrt{2} = 16.968V$

Allowing a safety margin of 1.5,

PIV = 1.5 X 16.968V = 25.452V

This value of PIV prompted the need of selecting a 2A bridge rectifier with peak reverse voltage of 100V made of silicon.

2.1.3 FILTERING CIRCUIT

The main function of a filter circuit is to minimize the ripple content in the rectifier output, the wave form is shown below.

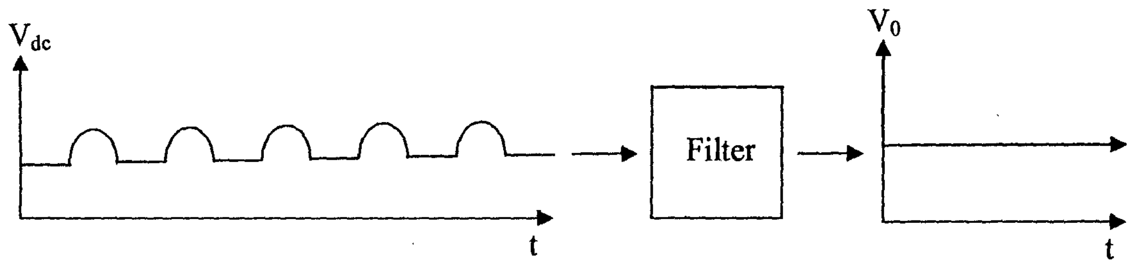


Fig 2.1.3. (a) Filter circuit

The electrolytic capacitor depends on its operation, the properties of the device to change up (store charges) during the conducting half cycle and discharge during the non-conducting half cycle. Shown below is the input waveform to the shunt capacitor its output waveform and the approximation of the ripple voltage.

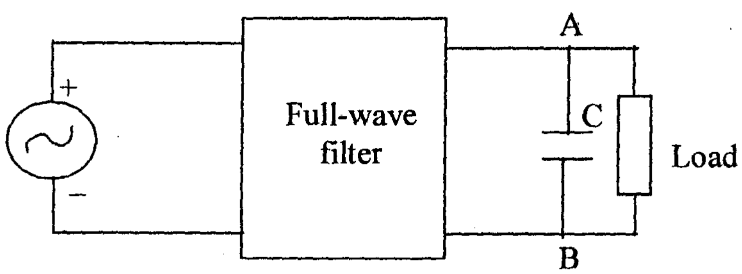


Fig. (b)

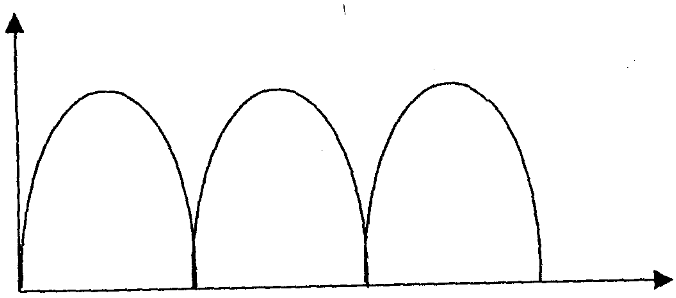


Fig. (c) Input waveform to the shunt capacitor filter

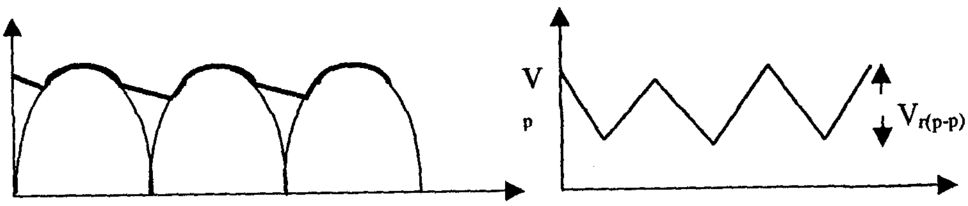


Fig.(d) Output waveform of the shunt capacitor and the approximation of ripple voltage by triangular waveform.

The capacitor smoothens the pulsating dc and gives a pure dc output voltage.

Fig d shows the ripple voltage.

$$V_{ripple} = V_{r.m.s} = \frac{V_{r(p\text{-}p)}}{2\sqrt{3}} \qquad \text{(i)}$$

$$V_{r.m.s} = \frac{I_{dc}}{4\sqrt{3}fc} \times \frac{V_{dc}}{2\sqrt{3}} \qquad \text{(full wave)} \qquad \text{(ii)}$$

Where f is the frequency of the sinusoidal a.c power supply voltage. Idc is the average current drawn from the filter by the load and c is the filter capacitance. Assume for light loads the value of V_{dc} is only slightly less than Vmax so that $V_{dc} = V_{r.m.s}$; where

$$V_{r.m.s} = \frac{I_{dc}}{4\sqrt{3}fc} \qquad \text{(iii)(full wave light load)}$$

$$= \frac{I_{dc}}{4\sqrt{3}fcR_1} \qquad \text{(iv)}$$

Where Idc is in milliamperes, c is in microfarads and R_1 is in kilo ohms.

$$V_{dc} = V_m - V_r\,(p\text{-}p) = V_m - (Idc/4\sqrt{3}fc) \times \frac{V_{dc}}{V_m} \qquad \text{(v)}$$

Again, using the simplifying assumption that Vdc is about the same as Vm for light loads, we get an approximate value of V_{dc} (which is less than V_m).

$$V_{dc} = V_m - \frac{I_{dc}}{4\sqrt{3}fc} \qquad \text{(vi)}$$

Where V_m is the peak-rectified voltage, in volts, I_{dc} the load current in milli amps and c the filter capacitance in microfarads.

Filter – capacitor ripple

$$r = \frac{V_{r.m.s}}{V_{dc}} \text{ X } 100\% \qquad \text{(vii)}$$

Since V_{dc} and I_{dc} relates to the filter load R_l we can also expressed the ripple as,

$$r = \frac{I_{dc}}{4\sqrt{3}fc} \text{ X } 100\% \qquad \text{(viii)}$$

CALCULATION

A bridge rectifier of high break down voltage of 100V was chosen to provide a full wave rectified voltage. Transformer secondary voltage

$$V_m = V_{r.m.s}\sqrt{2}$$

$$V_m = 12\sqrt{2}V = 16.97V$$

$$V_{r.m.s} = \frac{I_{dc}}{4\sqrt{3}fc}$$

The current consumed by the IC's and discrete components;

$I_{dc} = 100\mu A$; $C = 1\mu F$; $f = 50Kz$

$$V_{r.m.s} = 100 \text{ X } \frac{10 \text{ X } 10^6}{4\sqrt{3}} \text{ X } 10^{-6} \text{ X } 50 \text{ X } 10^3 = 0.29V$$

$$V_{r\,(peak)} = \sqrt{3} \text{ X } 0.29 = 0.50V$$

The dc level of the voltage across the capacitor $1\mu F = V_{dc}$

$$V_{dc} = V_m - V_{r\,(peak)}$$

$$V_{dc} = 16.97 - 0.50 = 16.47V$$

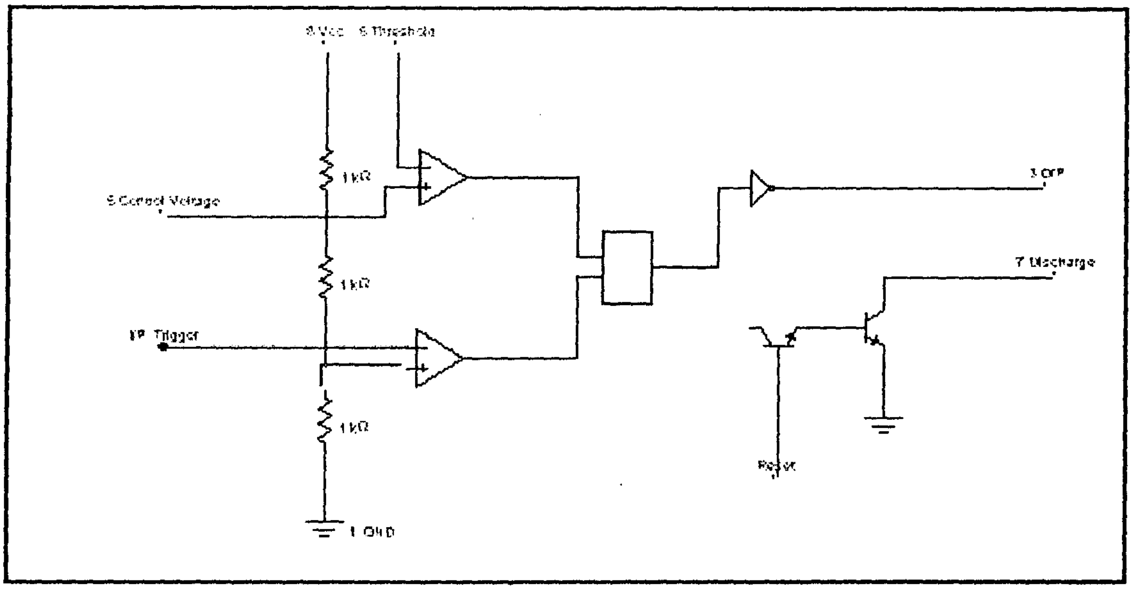
2.2 ENCODER (input mechanism)

The encoder consists of an assemblage of input bottom of a switch arranged in a matrix to generate numeric attractor (decimal digit) an depressing each key. It consist of ten, two terminal key/buttons which are normally open. The key/buttons are numbered

0-9. Depressing a button on the incorder generate a 4-bit (binary digit) code that represent the decimal number associated with the selected (security number) decimal number.

2.3 CLOCKING CIRCUIT:

This comprises of the pulse generating circuit and counting circuit. Electronic timing circuit such as the popular 555 timer Ic use a pair of comparator, a flip-flop, and various electronic equipment to generate a pulse whose length and duty cycle are controlled by an external R-C network ranging from a few micro records to several seconds. The entire circuit is package in a 5 pin dip with pin number specified in figure 2.3.1



The 555 timer is a monolithic timing consisting of two voltage comparators, threshold and trigger, a control flip-flop, a discharge transistor, a resistor voltage divider network and an output inverter buffer.

A series connection of three 1k Ω resistor internal to the IC sets the reference voltage level at ⅓v_{cc} and ⅔vcc when the threshold (pin6) voltage goes above ⅓'v_{cc} the Flip-flop is operated so that the output (pin3) goes low. In addition, the transistor discharge output (pin7) also goes. When the trigger output (pin 2) goes below v_{cc}/3,the flip-flop is operated to drive the output (pin 3) high, with the discharge transistor turned off. The control 1/p voltage (pin 5) allows the modification of⅔the ⅔V_{cc} level at comparator 1.The reset (pin 4) goes low and drives the discharge output (pin 7). The 555 timer IC can be externally connected to operate as a table or monostable multivibrator with external resistors and capacitors setting the frequency or timing period.

For the purpose of our design, the 555 timer shall be used in monostable multivibrator as in fig.2.3.1.

The trigger input at pin 2 going low operates the flip-flop driving the output high. The capacitor C will then change through resistor RA towards V_{cc} for time period of about T high =1.1Rc.

During the time output signal remain high. The capacitor voltage use until it is enough at the threshold input, 2/3 V_{cc} to operate comparator 1 which triggers the flip-flop driving the output back low. The discharge output also goes low, dropping the voltage across the capacitor near the 0v, where it remains until triggered again by an input signed to pin 2.

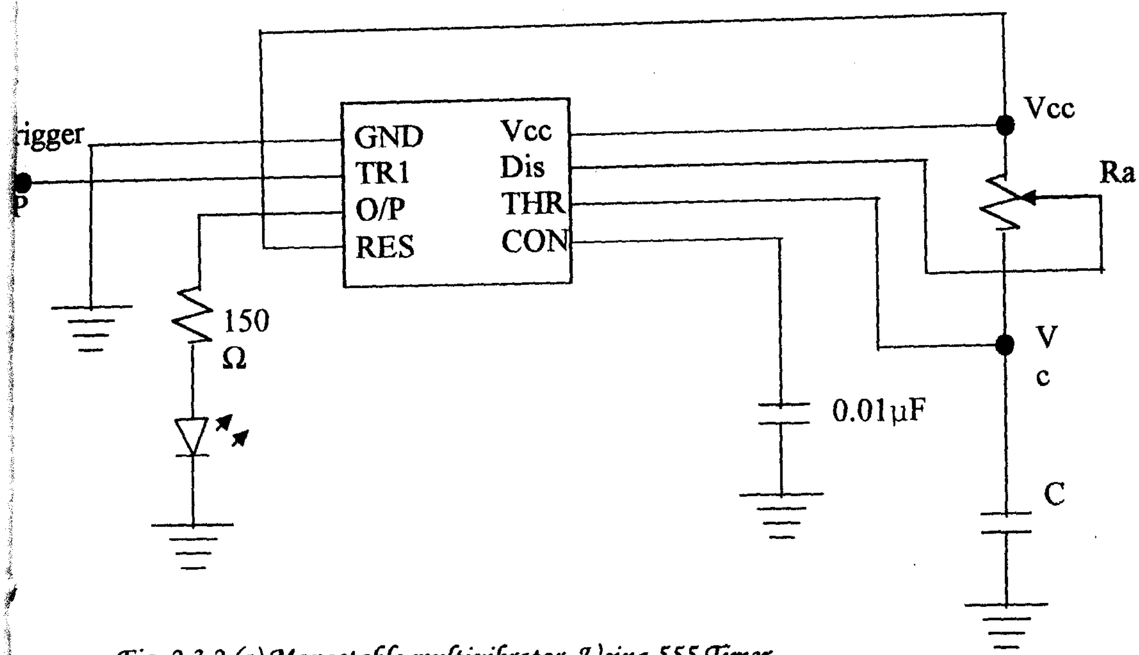
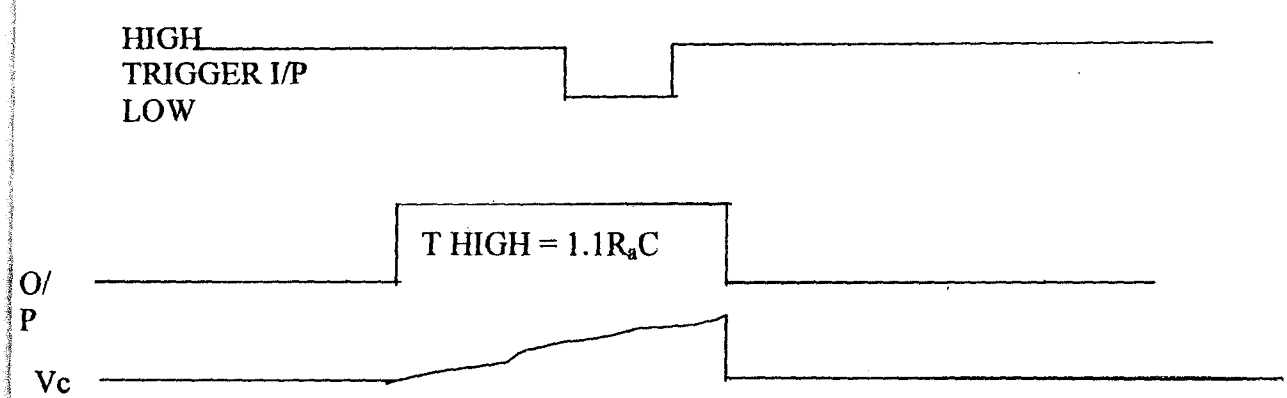


Fig. 2.3.2 (a) Monostable multivibrator. Using 555 Timer



(B) Circuit Waveform

CONDITION	TRIGGER	THRESHOLD	OUTPUT	DISCHARGE
A	Below Vcc/3	Below 2Vcc/3	HIGH	Open
B	Below Vcc/3	Below 2Vcc/3	Remember Last state	Remember Last state
C	Above Vcc/3	Below 2Vcc/3	Remember Last state	Remember Last state
D	Above Vcc/3	Above 2Vcc/3	LOW	G N D

Figure 2.3.3

The duration of the old state is given by T and is easily determined by the following:

The voltage across capacitor C is;

$V_c = V_{cc}(1 - e^{-t/RC})$ where the time constant T is RC

At t = T; $V_c = ⅔ X V_{cc}$

Alternatively; T = -Rc In (⅓)

T = 1.1 RC; C = 22μF

R is the variable resistor of value 200kΩ, which could be varied from 1kΩ to 200kΩ

R_i= 1kΩ; R_f= 200kΩ

$T_i = 1.1R_iC = 1.1 X 1 X 10^3 X 22 X 10^{-6}$

= 0.0242secs.

= 24.2 milliseconds.

$T_f = 1.1R_fC = 1.1 X 200 X 10^3 X 22 X 10^{-6}$

= 4.84 secs.

The duration pulse can be varied from 24.2 msecs to 4.84 msecs with the aid of the variable resistor.

2.4 COUNTING CIRCUIT

Counters are device, which records the number of pulses applied to its input. The basics component of a counter is the flip-flops, which can be connected in various arrangements to junction of binary counters that count input clock pulses.

Digital counters can be designed to have to the following features, modulus up and down counters synchronous or a synchronous operator, free running or self stopping.

In this project, a decade counter is achieved if the modulus is made to be 10 (that is, counting sequence is made to be from 0000 to 1001 in binary codes which translate to from 0 to g in decimal). The modulus 10 counter has four place values; 8s, 45, 25, and 15. This takes four flip-flop connected as a ripple counter as in fig 2.73.

A NAND gate is added to the ripple to clear all the flip-flops back to zero immediately after the 1001 (9) count. This is achieved when the unit to advanced to 1010 (10). The 2 highs (D=1 B=1) are fed into the NAND gate which activates and resets the display to 0000.

2.5 SWITCHING CIRCUIT

Switching means making breaking or changing the connection is on electrical circuit. The switching module interfaced the entire system with the ignition system of the automobile without this module, the aim of this project will not be activated. The switching circuit controls the supply voltage to the ignition system of the engine. The supply voltage is in the voltage of the selected decimal code inputted from the encoder.

For this design, a transistor (2N2222) and a relay were used for the switching circuit. The choice of the transistor as a switch is based on its reliability, long lasting, fast response and cheapness.

With the aid of transistor switch, a given load can be load "ON" or "OF" by a small control, which has two levels and one level, the transistor operates in the cut-off region (open) whereas with order level it operates in the saturation region and acts as a short circuit.

An NPN high-speed transistor (2N2222) silicon type was used and connected in the common emitter configuration as shown in the figure below. The small signal from the logic circuit (current and voltage) will produce a higher-switched output current or voltage at the collector output.

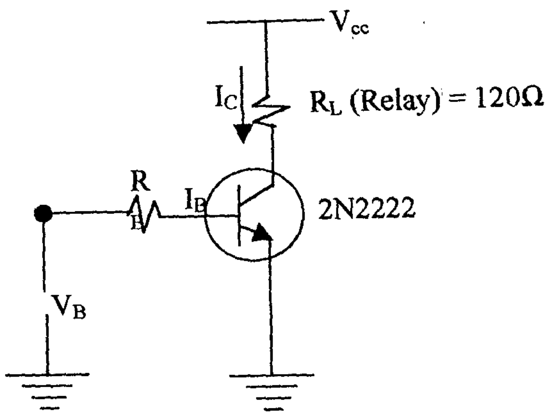


Fig. 2.4 Transistor as a switch.

CALCULATION

N.B, $R_B = 1k\Omega$; VB = ?V (base voltage).

From the data book (ECG data book); the data for 2N2222

$V_{BE(sat)} = 0.6V$ $V_{CE(sat)} = 0.35V$ $R_L = 120\Omega$

V_{cc} (supply voltage) = 12V

The current from the counter output drawn to energise the transistor through its base

$$I_B = \frac{V_B - V_{BE}}{R_B} \quad \text{(i)}$$

But from the expression $V_{cc} = I_C R_L + V_{CE(sat)}$

$$I_C = \frac{V_{CC} - V_{CE(sat)}}{R_L} = \frac{(12 - 0.35)V}{120\Omega} = \frac{11.65V}{120\Omega}$$

= 0.097A

= 0.1A

relating I_C and I_B; from the relationship;

$I_C = \beta I_B$ where $\beta = 100$ (transistor gain)

$I_B = I_C/\beta = 0.1A/100 = 10^{-3}A$

From I, above;

$$I_B = \frac{V_B - V_{BE}}{R_B}$$

Re-arranging we have; $V_B = I_BR_B + V_{BE}$

$$V_B = 10^{-3}A \text{ X } 1k\Omega + 0.6V$$

$$V_B = 10^{-3}A \text{ X } 10^3\Omega + 0.6V$$

$$V_B = 1V + 0.6V = 1.6V$$

That is, with a 12V, 12Ω relays used as a load to the transistor, the base voltage VB required to drive the transistor will be 1.6V.

The power dissipated in the transistor when operated in the "ON" state is given by;

Pdis = 0. /A * 0.35v= 35mw.

2.6 DISPLAY UNIT:

The display unit comprise of a decoder and a seven-segment display. The decoder is to detect the presence of a specified output level. The BCD-to-seven segment decoder/driver is a decoder that accept the BCD code on the input and provides output to energize the seven-segment display devices in order to produce a decimal readout signifying the selected input code from the encoder.

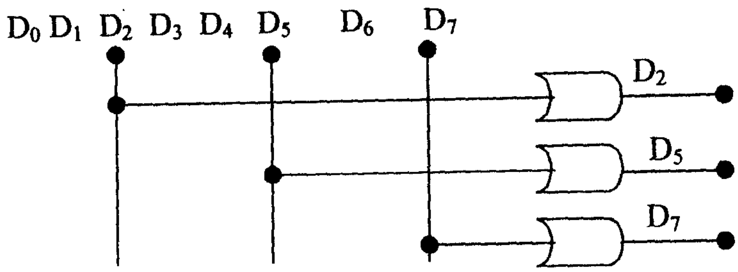
The table below shows the desired truth table for common cathode seven-segment decoder/drive.

DISPLAY	D C B A	A	B	C	D	E	F	G
0	0 0 0 0	1	1	1	1	1	1	0
1	0 0 0 1	0	1	1	0	0	0	0
2	0 0 1 0	1	1	0	1	1	0	1
3	0 0 1 1	1	1	1	1	0	0	1
4	0 1 0 0	0	1	1	0	0	1	1
5	0 1 0 1	1	0	1	1	0	1	1
6	0 1 1 0	1	0	1	1	1	1	1
7	0 1 1 1	1	1	1	0	0	0	0
8	1 0 0 0	1	1	1	1	1	1	1
9	1 0 0 1	1	1	1	1	0	1	1

The table below illustrates the low chemical number (selected number) are selected.

INPUT								OUTPUT		
D_0	D_1	D_2	D_3	D_4	D_5	D_6	D_7	A	B	C
0	0	0	0	0	0	0	0	0	0	0
0	0	1	0	0	0	0	0	0	0	1
0	0	0	0	0	1	0	0	0	1	0
0	0	0	0	0	0	0	0	0	1	1
0	0	0	0	0	0	0	0	1	0	0
0	0	0	0	0	0	0	0	1	0	1
0	0	0	0	0	0	0	0	1	1	0
0	0	0	0	0	0	0	0	1	1	1

From the table, $C = D_2$, $B = D_5$, $A = D_7$.



From the encoder circuit, the number 257 signifies the input to the combination look system. With this number, the switching circuit is energize which inturn energize the ignition system (Load).

2.7 MODE OF OPERATION

On depressing the key (2 5 7) on the encoder, the counter though the OR gate recenes the binary number representing the num 2,5,7. The counter inturn sends the resence data from its memory through a clothing circuit (comprising a submit trigger and D-latch) to the switching circuit and cacique thy the display unit (i.e to the decoder that drives the seven-segment, displaying the inputted number in decimal form. Meanwhile, the switching will at same time energize the load representing the ignition system.

CHAPTER THREE

3.1 CONSTRUCTION AND TESTING

In the hardware construction, the overall system was broken down into modules for easy construction, testing and troubleshooting.

1. Power supply unit
2. Encoder input unit
3. Clocking circuit unit
4. Switching unit
5. Display unit

Module 1: POWER SUPLY UNIT

This module was built with the bridge rectifier as the first component on the d Vero-board. The bridge rectifier has three rectifier connoted by the following signs: +ve (supply terminal); ~ (Ac input from the output transformer to the entire system) and -ve (ground --- zero voltage terminal). The positive was connected with the 12Vdc supply while the negative terminal (-ve) was connected to the ground or zero voltage live. Consequently, the transformer output signal from the transformer secondary) was fed to the circuit through the A.C symbol and the bridge rectifier. Having soldered the bridge rectifier, 220µf capacitors with their polarity identified, one of the capacitors was then soldered with the positive terminal soldered on the Vero-board immediately after the 220µf capacitor meant to filter the output voltage from the rectifier output. Consequently, the voltage regulator IC was soldered with respect to pin configuration, i.e. the input pin, ground pin ad the output, hence the remaining 220µf capacitor was soldered on the Vero-board. With the transformer input lead identified using a multimetre, (the side with higher resistance is the primary while the side with the lower resistance is the secondary) the transformer output up as then soldered to the AC terminal of the bridge neither. This module also has a switch (power switch) meant for putting out or switching on the voltage supplied to the circuit. Also included to the power supply module is power indicator, an LED that comes up when there is voltage in the circuit.

Module2: ENCODER/INPUT UNIT

This module comprises the array keys/bottoms which when depress will energize the clocking circuit and subsequently, the display and the switching unit. It was built with bounce switches numbered from 0-9, and to each button is an IDE solder (integrated digital electronics) cable was an connected and the IDE cable was then used to interfaced the encoder and the other part of the circuit through its female pins.

Module 3 CLOCKING CIRCUIT

This module comprises a counter, schmitt trigger and a D-latch SN7415 used as a memory device. This component (IC's) were installed through the soldered IC's socket on the Vero-board, after identifying various pin configuration. The counter output was connected to the D-latch IC SN7415, through the schmitt trigger IC
(555-time). All the connection was made with connecting wire soldered to respective pin number.

Module 4: SWITCHING UNIT MODULE

This module comprises a relay and a transistor (AND-gate transistor) connected in voltage amplifier mode. With the aid of a digital multimetre, the relay terminal was identified as N/O (normally open), N/C (normally close) and the relay coil terminal was also checked to ensure to no open circuit condition within the coil.

The relay was then soldered on the Vero-board. Furthermore with the aid of the digital multimetre, the emitter, collector, and the base of the transistor was also determine and then soldered on the Vero-board with its collector connected to the relay coil through a diode connected across the relay coil. The diode's cathode as well as the relay coil was connected to the supply line. This module interfaced the entire system with the load (electric bulb) representing the ignition system of the car/vehicle.

Module 5: DISPLAY UNIT

This module consists of a seven-segment display and decoder. The decoder decodes the encode signals from the encoder and relates it to the seven-segment display, hence the security number is been displayed. The decoder IC was inserted on the IC socket that was soldered on the Vero-board, with respective pin configuration noted and connected using connecting wire is seven segment display. With the aid of the digital multimetre, the cathode was identified as well as the anode. The cathode terminal was then connected to decoder output.

3.2 COMPONENT LAYOUT

The following was observed and carried out while constructing the hardware system.

1. The IC was mounted/inserted on the IC socket already soldered on the Vero-board to ease replacement of any faulty IC in every future fault.
2. Inter connection was made through earthning of the bottom of the Vero-board the Vero-board and the use of insulated copper wire connected, while the components were mounted on the top of the Vero-board and then soldered underneath thus

giving the components good layout and space for trouble shooting and replacement of the faulty components.

3. The long legs or leads of various components such as transistors, resistors and capacitors was reduced in the aim of reducing the occurrence of short circuit.
4. Having made necessary connection and soldering on the Vero-board, proper care was taken to avoid short circuiting by thorough examination of the connecting line and the non-connecting line. This was to ensure that the resulting current was supplied across the entire system.

3.3 CONTRUCTION

Most of the construction tool used during the modeling and hardware construction are giving below.

1. Project board and insulated copper wire (used as jumpers) these component was used in building part of the proto type model for test before the circuit was finally transferred to the Vero-board permanently.
2. Soldering iron is lead. A 40watt soldering iron and lead was used in the cause of soldering of all components on the Vero-board.
3. Digital multimetre. This electronic device was used in carrying out continuity test, as well as terminal coil test (as in the case of a relay) and in measuring the values of resistor (resistance). Other component includes the transistor, whose base, emitter and collector were also determined by the digital multimetre.
4. Lead sucker. This was employed in removing molten lead from de-soldered components on the Vero-board.

5. Precision screwdrivers because of the various shapes and sizes of the set of screwdrivers it was employed in screwing bolt and nut during packaging as well as in incorporating the de-bounce switches that make up the encoder unit.

3.4 HARDWARE TESTING

After the completion of the hardware construction, a careful hardware test of the completed circuit was carried and as follows.

STEP1: continuity of the copper wire used in the construction was tested using digital multi-meter.

STEP2: A digital multi-meter was also used ascertain the absence of short circuit between the supply line (+ve) and the ground (-ve).

STEP3: polarity of the power supply was tested using a digital multimetre to ensure adequate link to the "electronics combination lock system" as well as the identification of the reverse bias to the forward bias of the diode used in the construction of the hardware.

STEP 4: The output voltage of the transformer (secondary voltage) was observed and measured to $12V_{ac}$ as required.

STEP 5: The encoder keys were depressed and reset to ensure good performance.

STEP 6: The switches and reset buttons were tested and certified O.K.

STEP 7: The overall operation of the circuit was tested by depressing the selected keys.

CHAPTER 4

DISCUSSION, CONCLUSION AND RECOMMENDATION

4.1 DISCUSSION OF RESULT

The result carried out after the circuit was simulated reveals that the system (Electronic Combination Lock System for Vehicle Ignition) operates based on logical operation that involves the selection of number when specific code (security code) is outputted into the car ignition system by means of the encoder. The system on receiving the selected code (security number), usually from the encoder (bounce switches, number 0-9) through the IDE (integrated digital Electronics) cable find its way to the switching circuit through the counter IC within a predetermine line. Hence, the entire system is digitally operated system.

4.2 CONCLUSSION:

The motive and objective of the project was realized as observed from the hardware testing and operation had proving that an Electronics Combination Lock System can be constructed from the basic understanding of digital electronic by the bounce switching IDE cable, counter IC Schmitt trigger as well as a logical operated switching circuit.

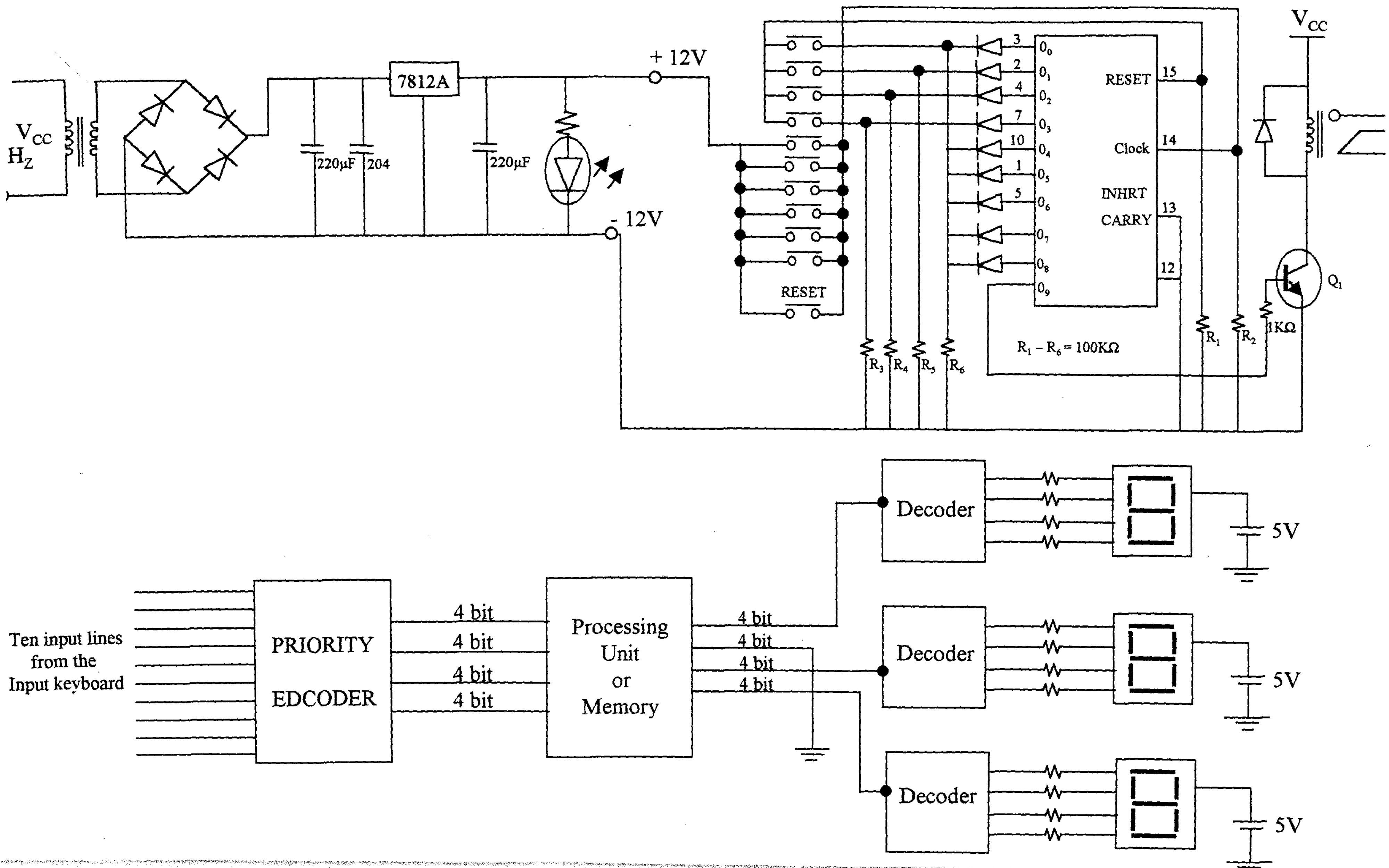
The low operating voltage, $12v_{dc}$, and low power consumption of the system allows for effective performance, low overall cost and operation, thus resulting in high reliability of the system in car/vehicle security system.

4.3 RECOMMENDATION

My desire as an electrical and computer engineering is to fully integrate the discipline into other profession such as the automobile industry, security industry as well as other engineering profession.

Furthermore, up-coming student should in their endeavor develop same system without any electrical contact between the output of the electronic combination lock and the car ignition system, hence an electromagnetic wave means of interaction between the both systems.

CIRCUIT DIAGRAM



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