DESIGN AND CONSTRUCTION OF A REMOTE CONTROL FOR MULTIPLE APPLIANCES.

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DEDICATION

This project is dedicated to my **MOTHER (Mrs Jimoh Islamiyyat)**, may her soul rest in perfect peace.

DECLARATION.

I *Olatoyan Moruf Olayemi*, 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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Signature and Date.

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Signature and Date.

AKNOWLEDGEMENT.

I thank Almighty God for thy complete blessing on me throughout my studies.

Regards to my dad and maternal grand mum for their wonderful support.

Also my regards to Mr. and Mr.'s Sulaiman, I cannot thank them enough for their parental care that can neither be rebuke, and to the entire member of Sulaiman family; Onono (Nafisat), Nana-Hauwa, Ummulkhair, Hameed, Muh'd Kabir, etc for their affectionate relation. May Almighty Allah increases your Al-bar'ka.

I would also use this opportunity to express my profound gratitude to all my friends, most especially; Bello D. Yunus, Fagbemi F. Adedeji, Adeniyi Olorunfemi and Owosuyi Adedayo, Abubakar Dahiru, for their comprehensive support.

I will always remember my supervissor; Mr. Omokhafe J. Tola and my Lab. Supervissor; Mr. Ajibuwa for their kindness and patience in the course of my project. May God continue thy blessing on you and your entire family (amen).

It is with uthmost respect to express my words of gratitude to all the entire staff in ELECT. And COMP. engineering department. starting from Engr. A. G. Raji, Prof Usifo, Mr James Ambafi, Dr Elizabeth Onwuka, Mr Henry Ohianzi, Dr. Nwohu, etc.

Henceforth, my regards go to all my brothers; Hameed, Kabir, Jamiu and sister, we will leave to share the grace of almighty Allah.

ABSTRACT

Conveniency in the operation of the appliances are very importance to man. This project designed and constructed is a remote control for multiple appliances. It was constructed using an electronics chips (microcomputer) that understand and control the device via the receiver, it is done using principle of light signal from the infra red. The device is powered by 6V DC and power indicator shows that the circuit is energized with battery. It reduces the stress undergo in controlling different equipment at the same time, especially by the disable people.

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CHAPTER ONE

GENERAL INTRODUCTION

1.0 INTRODUCTION

A remote control is a component of an electronics device, used for operating the device wirelessly from a short line-of-sight distance.

The remote control can be contracted to remote or controller. It is known by many other names as well, such as converter clicker, didge, flipper, the tuner, the changer, or the button. Commonly, remote controls are Consumer IR devices used to issue commands from a distance to televisions or other consumer electronics such as stereo systems, DVD players and dimmers. Remote controls for these devices are usually small wireless handheld objects with an array of buttons for adjusting various settings such as television channel, track number, and volume. In fact, for the majority of modern devices with this kind of control, the remote contains all the function controls while the controlled device itself only has a handful of essential primary controls. Most of these remotes communicate to their respective devices via infrared (IR) signals and a few via radio signals. Television IR signals can be mimicked by a universal remote, which is able to emulate the functionality of most major brand television remote controls. They are usually powered by small AAA or AA size batteries [1].

With advancement in engineering technology over the year's life has been made easier since engineers think on the advancement of technology every second. This is done by introducing

and advising new method of identifying and solving problems. The problems could be mechanical, electrical, structural environmental, etc.

Electrical engineering is said to be the findings of electrical problems with solution to various human needs via the use of electrical components. One of the major problems faced by man is unable to control its appliances with conveniences and the protection from disaster majorly from electric.

As a result of the convenience and comfort derived from controlling most of the appliances by mere pressing of a button from a distance, it becomes a matter of interest to expand this convenience to both electrical and non-electrical appliance such as lightning of a bedroom bulbs and even opening and closing of the entrance(gate), using infra-red remote control.

In the scheme of things, this project features a single channel (on/off) that may be used with any infra-red remote control that operate at a particular frequency (Hz). It can be used to operate multiple appliances at a time, from one and above e.g. TV, video set, CD players, night lamp, electric door, etc. virtually any house hold appliances.

By the early 2000s, the number of consumer electronic devices in most homes greatly increased, along with the number of remotes to control those devices. According to the Electronics Association, an average Nigerian home has four remotes. To operate a home theater as many as five or six remotes may be required, including one for cable or satellite receiver, VCR or digital video recorder, DVD player, TV and audio amplifier. Several Consumer one of these remotes may need to be used sequentially but, as there are no accepted interface guidelines, the process is increasingly cumbersome.

Many specialists, including Jakob Nielsen, a renowned usability specialist and Robert Adler, the inventor of the modern remote, note how confusing, unwieldy and frustrating the multiplying remotes have become. Because of this proliferation of remote controls, universal remote controls that manage multiple devices are becoming increasingly popular.

Remote for multiple appliances imply that any button of any remote control may be used to work this switch. The button has to be pressed for up to two seconds delay before the relay will triggerto operate the device. The circuit will remain in the on state (latched) until reset. To reset it thereafter, any button is pressed and held for the same time to trigger back [2]. The remote switch can be used to operate any device provided the relay contact can withstand the rated voltage and current of the load.

This motivated the design and construction of a reliable cost effective control with protective function which is the primary aim of this project.

1.1 SCOPE OF THE PROJECT

The invention relates generally to the remote control of home entertainment devices and other similar devices. It entails the selection of single device out of many.

1.2 PROJECT OBJECTIVES AND MOTIVATION

The main aim of carrying out this project is to develop a circuit that can be used to switch on or off of any electrical or electronics appliances connected to it via the receiver. This will

make it more convenient to operate the house hold by saving the time and energy of the user especially the physically challenged people. The objective of the project is as follows;

- To improve the measures of convinience in the mode of operating the home appliances.
- To acquaint me with basic tools and materials in electrical and computer and develop my skill in their use.
- To improve my skills in both theory and practice of circuit analysis.
- To encourage research and methods for data acquisition.

1.3 METHODOLOGY

To achieve the stated objective, the following step was adapted;

- A signal will be sent to the receiver from the transmitter
- The receiver sense it and decode the signal
- The processor process it and output will be released to the load

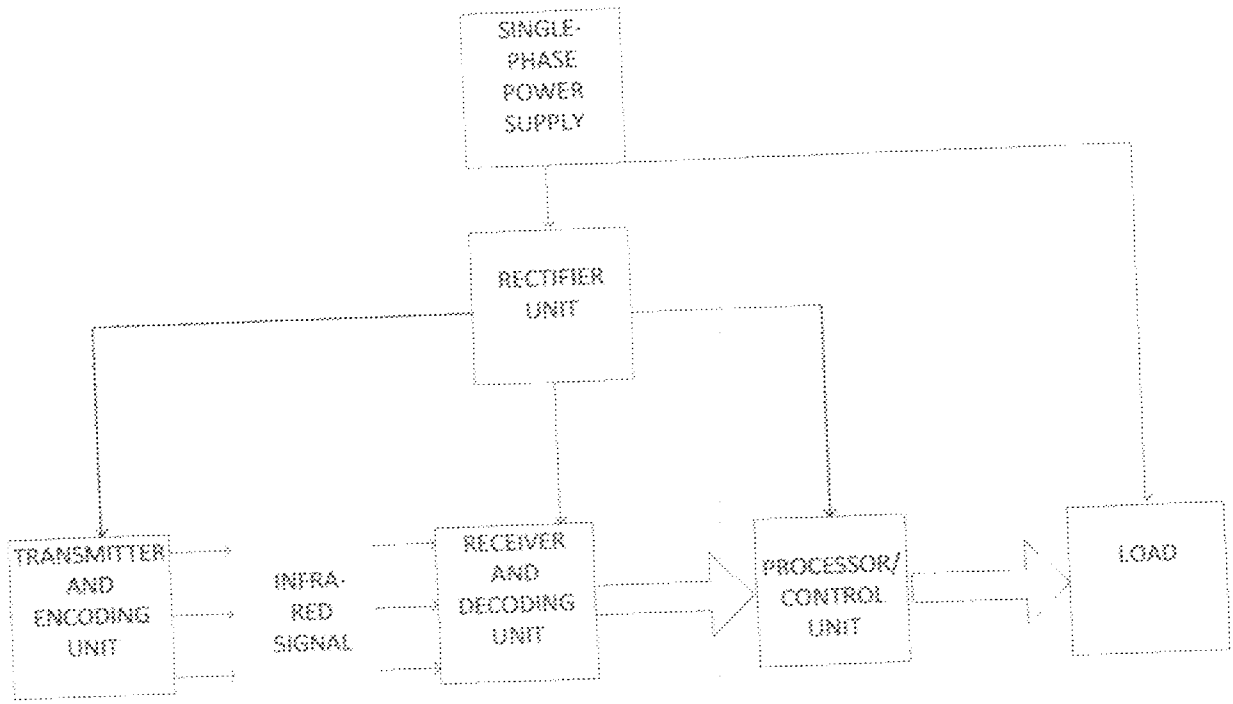
SINGLE-
PHASE
POWER
SUPPLY
RECTIFIER
UNIT
TRANSMITTER
AND
ENCODING
UNIT
INFRA-
RED
SIGNAL
RECEIVER
AND
DECODING
UNIT
PROCESSOR/
CONTROL
UNIT
LOAD

Fig. 1.1

CHAPTER TWO

LITERATURE REVIEW

2.1 HISTORICAL BACKGROUND

One of the earliest examples of remote control was developed in 1898 by Nikola Tesla, and described in his patent, U.S. Patent 613,809, named method of an Apparatus for Controlling Mechanism of Moving Vehicle or Vehicles. In 1898, he demonstrated a radio-controlled boat to the public during an electrical exhibition at Madison Square Garden. Tesla called his boat a "teleautomaton" [3].

In 1903, Leonardo Torres Quevedo presented the Telekino at the Paris Academy of Science, accompanied by a brief, and making an experimental demonstration. In the same time he obtained a patent in France, Spain, Great Britain, and the United States. The Telekino consisted of a robot that executed commands transmitted by electromagnetic waves [4]. It constituted the world's first apparatus for radio control and was a pioneer in the field of remote control. In 1906, in the presence of the king and before a great crowd, Torres successfully demonstrated the invention in the port of Bilbao, guiding a boat from the shore. Later, he would try to apply the Telekino to projectiles and torpedoes, but had to abandon the project for lack of financing.

The first remote-controlled model aero plane flew in 1932, and the use of remote control technology for military purposes was worked intensively during the Second World War, one result of this being the German Wasserfall missile.

By the late 1930s, several radio manufacturers offered remote controls for some of their higher-end models. Most of these were connected to the set being controlled by wires, but the Philco Mystery Control (1939) was a battery-operated low-frequency radio transmitter, thus making it the first wireless remote control for a consumer electronics device.

The infrared remote control is made up of a transmitter and a receiver (Photo detector). The transmitter transmits light with a particular color within the reference frequencies of 480 KHz and 455 KHz having a wave length of about 950nm. This is just below the red part of the visible light spectrum, and cannot be seen by the human eye [5]. The control works by pressing a button on the transmitter, which sends signals by a binary code, a series of logical zeros and ones having different combinations to tell the receiver what to do. These codes hold information, like the address to the receiver i.e. the particular receiver the information was meant for and also to the appropriate location, with commands to be executed. The first thing the transmitter sends to the receiver is called the header. The header is a burst of high that alerts all the infrared receivers in an area.

After the header comes the code which includes the address to the specific receiver that is to be operated. Then comes the command that tells the receiver what to do, this command will continue as long as a button on the transmitter is held or pressed down when the botton is released a string of code as sent to the receiver telling it to stop.

2.2 COMPONENT THEORY

The components used in the project are analyzed below:

2.2.1 Transistor

Transistors are active components used basically as amplifiers and switches. The two main types of transistors are the bipolar junction transistors whose operation depends on the flow of both minority and majority carriers, and the unipolar or field effect transistors (called FETS) in which current is due to majority carriers only (either electrons or holes). The transistor as a switch operates in a class 'A' mode. In this mode of bias the circuit is designed such that current flows without any signal present. The value of bias current either increased or decreased about its mean value by input signals (if operated as an amplifier), or ON and OFF by the input signal if operated as a switch. Basically, transistor consists of two P-N junctions formed by sandwiching either P-type or N-type semiconductor between a pair of opposite types. When a third doped element is added to a crystal diode in such a way that two P-N junctions are formed, the resulting device is known as a transistor [6]. They are capable of amplifying weak signals. Transistors fall into two main classes – bipolar junction transistors (BJT) and field effect transistors (FET) [7]. A BJT consists of two back to back *PN* junctions manufactured in a single piece of semiconductor material. These junctions give rise to three regions called emitter, base and collector. The emitter is heavily doped since it is to supply majority charge carriers to the base which is lightly doped and at the middle section of the transistor. The collector is physically larger than the emitter because it has to dissipate more power. The transistor is operated by forward biasing the emitter – base junction and

reverse biasing the collector – base junction. The symbol below shows the representations of a transistor.

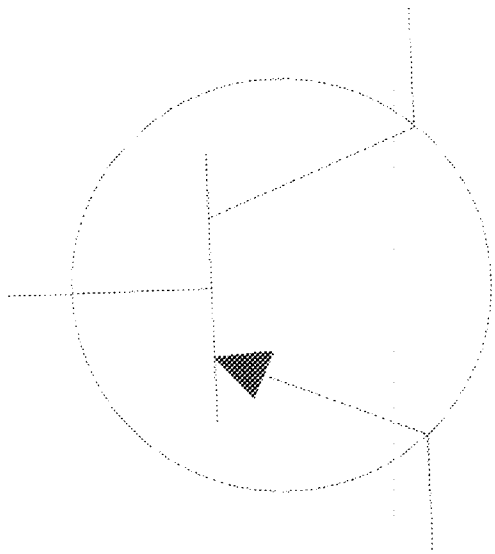

Fig 2.1 Transistor symbol

2.2.2 Resistor

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 resistivity's in the order of 10^{-7} to 10^{-8} Ωm, semiconductors have resistivity's in the order of 10^{-3} to 3×10^{3} Ωm, and the resistivity's of insulators are in the order of 10^{8} to 10^{14} Ωm [8]. The resistance of an electrical conductor depends on four factors, these being: (a) the length of the conductor,

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.

$R = \rho l/A$ [9].

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. 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.

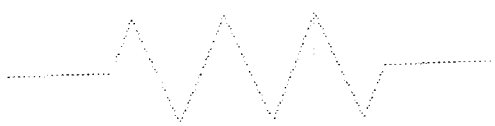

Fig 2.2 Resistor Symbol

2.2.3 Capacitor

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.

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

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

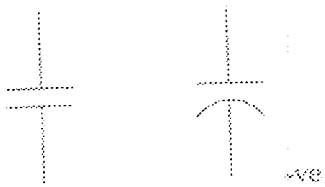

Fig 2.3 capacitor symbol.

2.2.4. Relays

A relay is an electromagnetic switch. A small current flowing through a coil in the relay creates a magnetic field that pulls one switch contact against or away from another [10]. In this project, relays served as electromechanical switches which make and break feeding the system power and interrupting it at will.

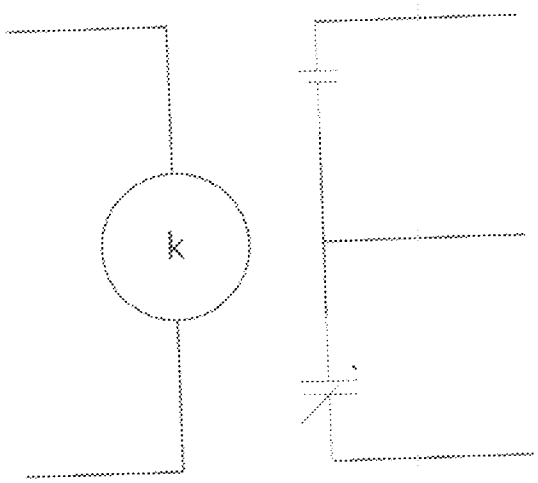

Fig 2.4 Relay Symbol

2.2.5 Diode

A diode is an electrical device allowing current to move through it in one direction with far greater ease than in the other. The most common kind of diode in modern circuit design is the semiconductor diode, although other diode technologies exist. 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 et.c. Silicon (Si) and Germanium (Ge) are common examples of semiconductors

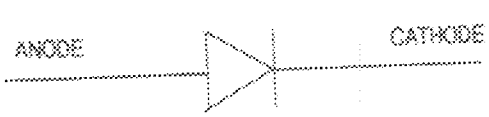

Fig 2.5. Circuit symbol of a diode.

Semiconductor diode schematic symbol when placed in a simple battery-lamp circuit, the diode will either allow or prevent current through the lamp, depending on the polarity of the applied voltage.

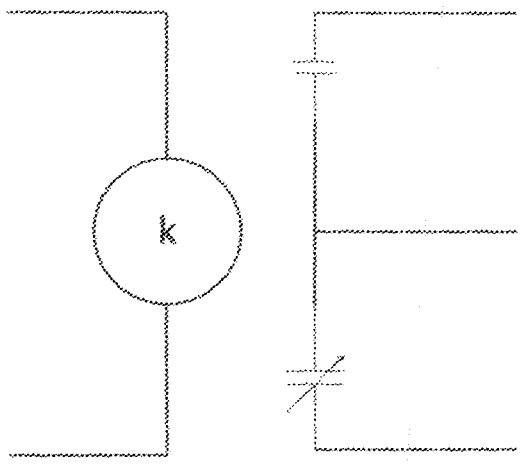

Fig 2.4 Relay Symbol

2.2.5 Diode

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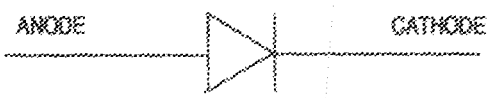

Fig 2.5. Circuit symbol of a diode.

Semiconductor diode schematic symbol when placed in a simple battery-lamp circuit, the diode will either allow or prevent current through the lamp, depending on the polarity of the applied voltage.

2.2.6. Microprocessor

This is an electronic circuit that functions as the central processing unit of a computer providing computational support. These devices are used to control *smart machines* such as microwave ovens, clothes washers, sewing machines, auto ignition systems and metal lathes [11]. Some currently available devices in this category- the Intel 8051 and Motorola M58484P, M58485P, M58480P, for example- contain programmable counters and a serial port (UART) as well as a CPU, RAM, ROM and parallel I/O ports. The diagram below reveals the architecture of the common M58484P microproc.

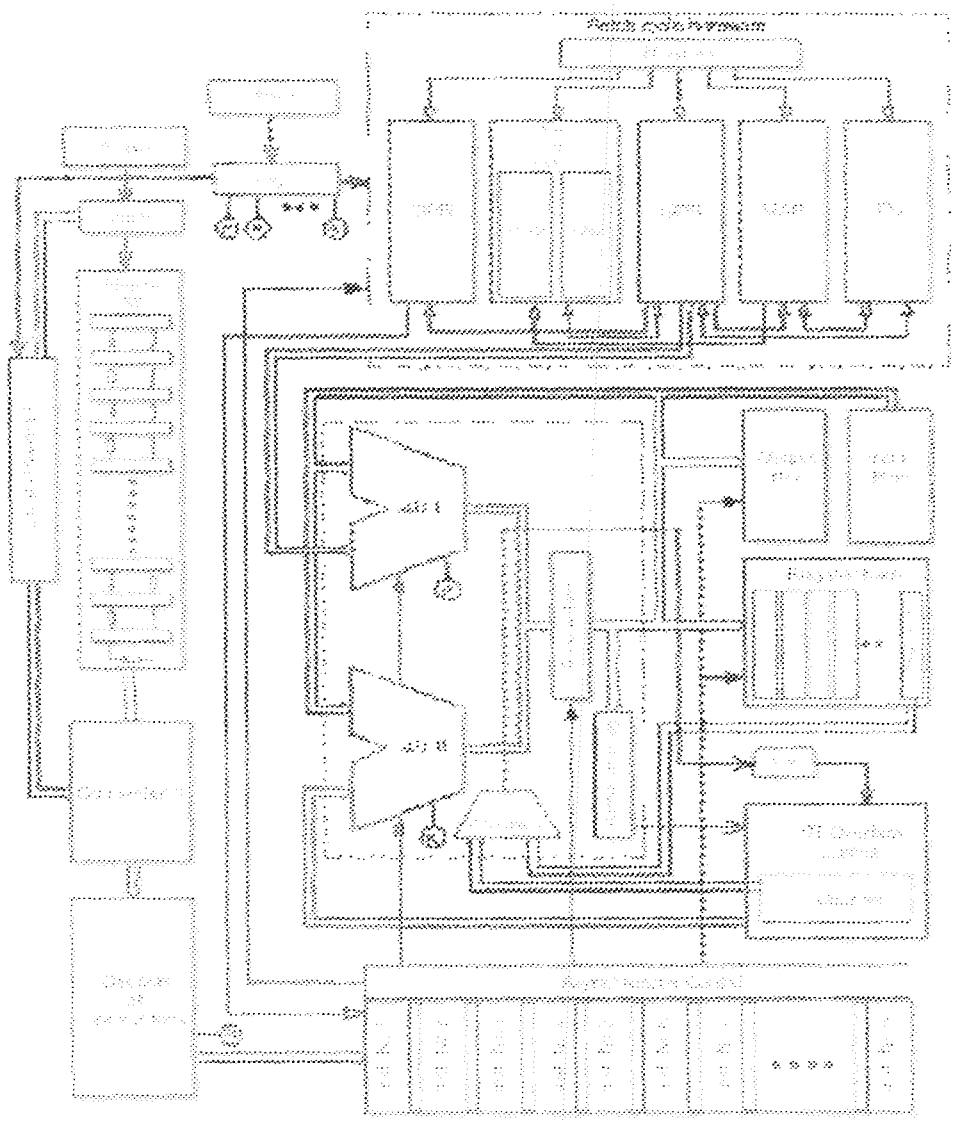

Fig 2.6. M58484P standard Architecture.

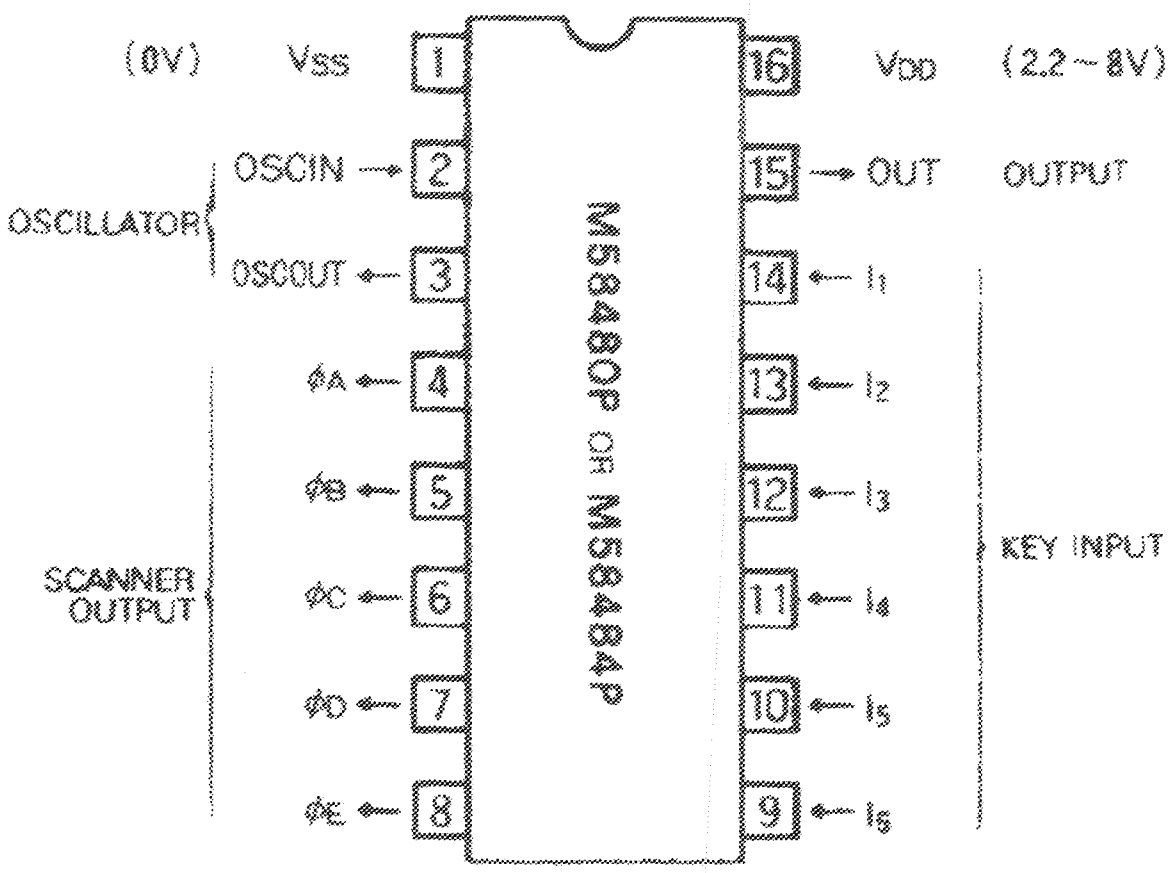

Fig 2.7. Pin out Diagram for M8484P chip.

The M58484P is a 30 function remote control transmitter circuits used to power difference appliances such as TV, via the receivers. It conveys difference commands on the basis of 6-bit PCM code. Mostly it is used in conjuction with M58480 as the receiver.

FEATURES

- Single power supply with wide supply voltage range of 2.2V – 8V
- Low power dissipation i.e. $V_{DD} = 3V$
- On chip oscillator
- Low cost ceramic oscillator used in determining reference frequency
- Low transmitter duty cycle for minimal power consumption

FUNCTION

The M58484P or M58480P transmitter circuit for infra-red remote control system consist of an oscillator, a timing generator, a scanner, key in encoder, an instruction decoder, a code modulator and an output buffer. With the keys commands can be transmitted by 6 bit PCM code. Oscillation is stopped when none of the keys are depressed to minimize power consumption.

APPLICATION

-Remote-control transmitters for TV and other appliances

2.2.7. Conductors

The conductors used are cupper which is due to their high conductivity. They are of different lengths and are pushed into the soil to a certain level which is for normal operation. When water level touches all the conductors, the machine wouldn't pump water. It can only pump

water once water level drops at 50% thereby allowing only two of the longest electrodes to touch the water.

2.2.8. Crystals

Quartz crystals, cut into thin plates and with electrodes plated onto opposite flat faces, can be used as resonant circuits with Q values ranging from 20 000 to 1 000000 or more [12]. They are all piezoelectric and can therefore be used as transducers (sender or receiver) for ultrasonic waves [8]. The equivalent circuit of a crystal is shown below.

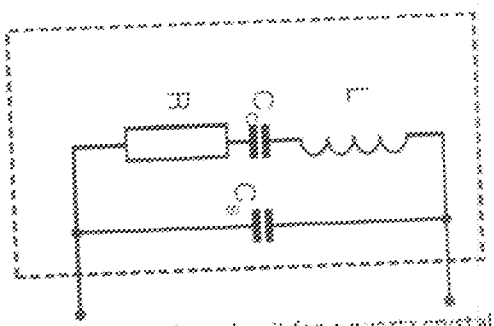

Fig. 2.8. Equivalent circuit for a quartz crystal .

The L and C values in this equivalent circuit are referred to as *motional inductance* and *motional capacitance*, and values will be specified by the manufacturer. These values, with a very high ratio of L to C, could not be provided by any assembly of separate components, and it is that which provides the very high Q-factor. The crystal by itself acts as a series resonant circuit with a very large inductance, small capacitance and fairly low resistance (a few thousand ohms). The stray capacitance across the crystal will also permit parallel resonance to occur at a frequency that is slightly higher than that of the series resonance. This is a highly important component in the project since it determines the performance of the system.

CHAPTER THREE.

DESIGN AND IMPLEMENTATION.

3.1. INTRODUCTION.

The project was achieved as explained in the block diagram shown below:

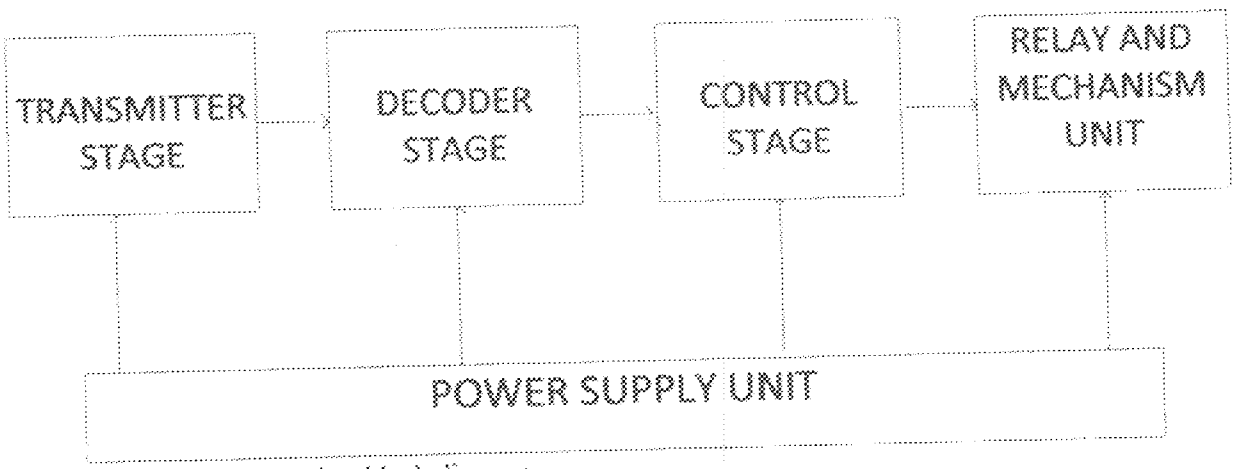

Fig3.1 complete block diagram.

3.2. POWER SUPPLY UNIT.

This consists of step down transformers which are to step down the input voltage from 220V to 12V. It has current rating of 1A, to achieve the power which would be enough to power the mechanism. The outputs of the transformers are rectified using bridge rectifiers and the ripple of the output from each rectifier is filtered via a capacitor. The unit is analyzed below.

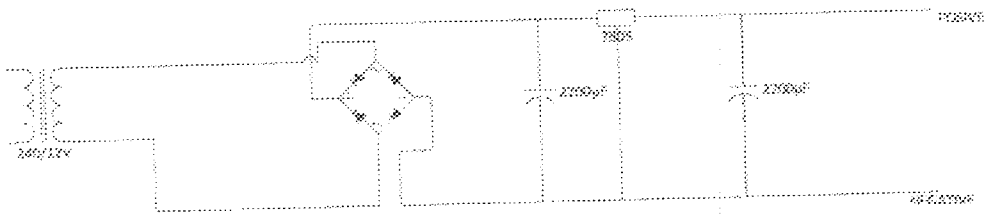

Fig 3.2 power supply circuit diagram

$Q = CV = It$. If V is the ripple voltage which is the output of the rectifier, then $V = \delta V =$

Peak Voltage − Vmin.....3.1

Peak Voltage= $\sqrt{2}$ ×Vrms.....3.2

Vrms = 12V ∴Peak Voltage= $12\sqrt{2} \cong 16.9V$

Since a silicon rectifier is used, 1.4V is subtracted from the peak voltage

=Peak Voltage≈ $15.5V$.

But Vmin =Vreg + head.....3.3

For this system to work well even when PHCN supply is low (at about 180V), the peak voltage at 180V is calculated from 3.2. However, Vrms at 180V is calculated as:

$220V\ (A.C)\ would\ yeild\ 12V(D.C)$

$180V(A.C) would\ yeild\ \frac{(120 \times 12)}{220} \cong 9.8V$

⇒Vpeak = $9.8\sqrt{2} \approx 13.74V$ but because a silicon rectifier was used,

Vpeak≅ $13.94 - 1.4 = 12.3V$ which is the minimum voltage for the system to operate.

$\therefore \delta V = 15.5 - 13.3 = 3.2V$

From 2.2, 2.3 and 3.1, as already known,

$C\delta V = It$, I = 0.5A, C = C_1 while

$t = \frac{1}{2f}$ $where$ $f = 50Hz$ $\therefore t = \frac{1}{2\times50} = 0.01s$

$$\therefore C1 = \frac{0.01 \times 0.5}{3.2} \cong 1563\mu F$$

A 2200μF was chosen for C_1 since it fell within range. To calculate for C_2,

I =2(1A) = 2A since the two transformers are cascaded, t = 0.01s, Vpeak = 15.5V and from testing the pump and the motor that moves the nozzle so as to cover a wider area, it would take a minimum of 5V for them to be driven.

$\therefore \delta V = 15.5 - 5 = 10.5VC2 = \frac{0.01\times2}{10.5} \approx 2200\mu F.$

3.3. TRANSMITTER STAGE.

The transmitter usually is powered by a battery. It will consume as little power as possible and the IR signal should also be as strong as possible to achieve an acceptable control distance.

For this project, a 4.5 to 6 volts battery was used.

It samples the incoming electrical signal and then quantizes it so that the signal are represented by discrete levels. After the signal has been transformed to discrete, they are

modulated by the network generated by RC network. The RC network determines the carrier frequency that will transmit the IR signal.

Using: $f = \frac{1}{1.1\,RC}$

Where f is the carrier frequency generated which was calculated as 760kHz. The circuit diagram is shown in fig 3.2

Fig 3.3 shows the block diagram of the basic operation of tansmitting IC.

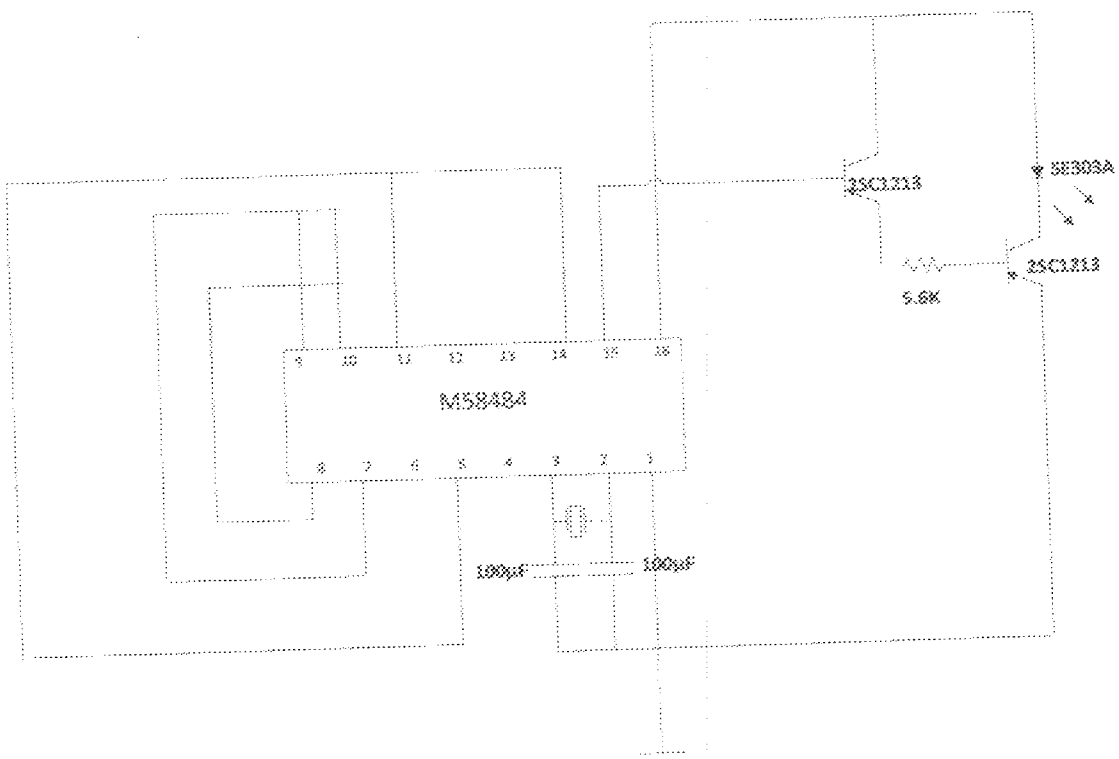

Fig 3.3 Transmitter stage circuit diagram.

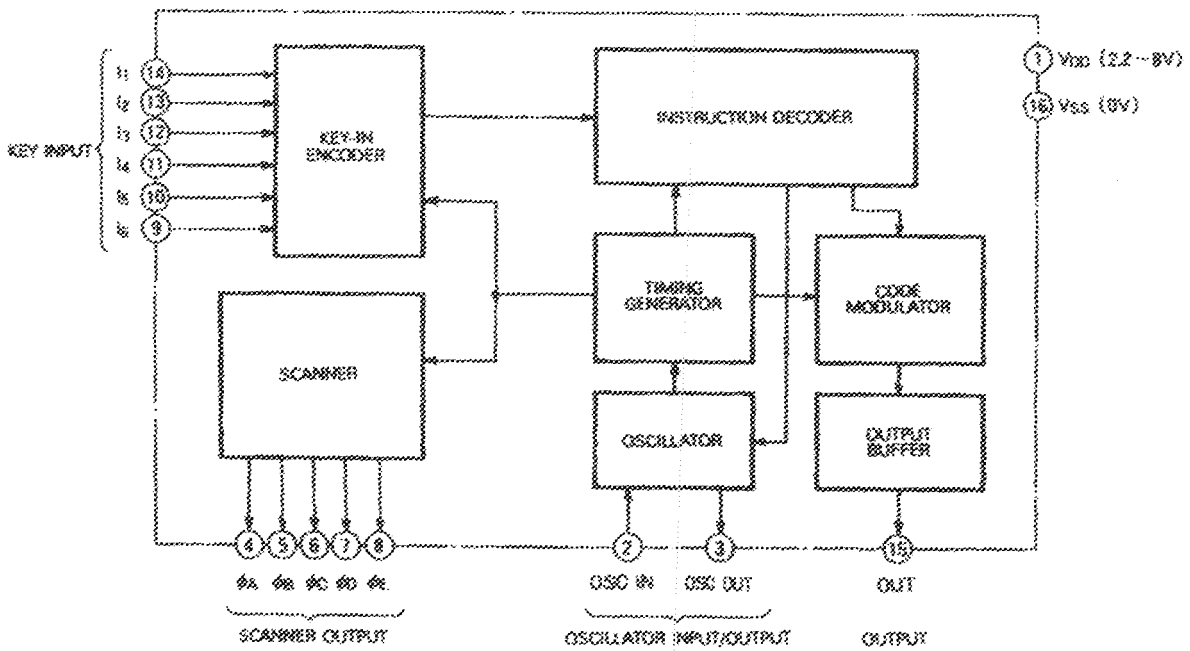

Fig 3.4 M58484P block diagram

3.4. DECODER STAGE.

Pre-amp circuit serves as the receiving point that connects to the decoding unit. It contain pre-amp IC that makes the signal more meaningful to the main decoder IC because the signal might have been attenuated thereby passing through pre-amplifier to reproduce the signal in the exact form. It properlly distinguishes the discrete level. To avoid the receiver not to mis-interprete one discrete level to another discrete level. The circuit diagram in fig 3.4 carry out the operation in the decoding stage.

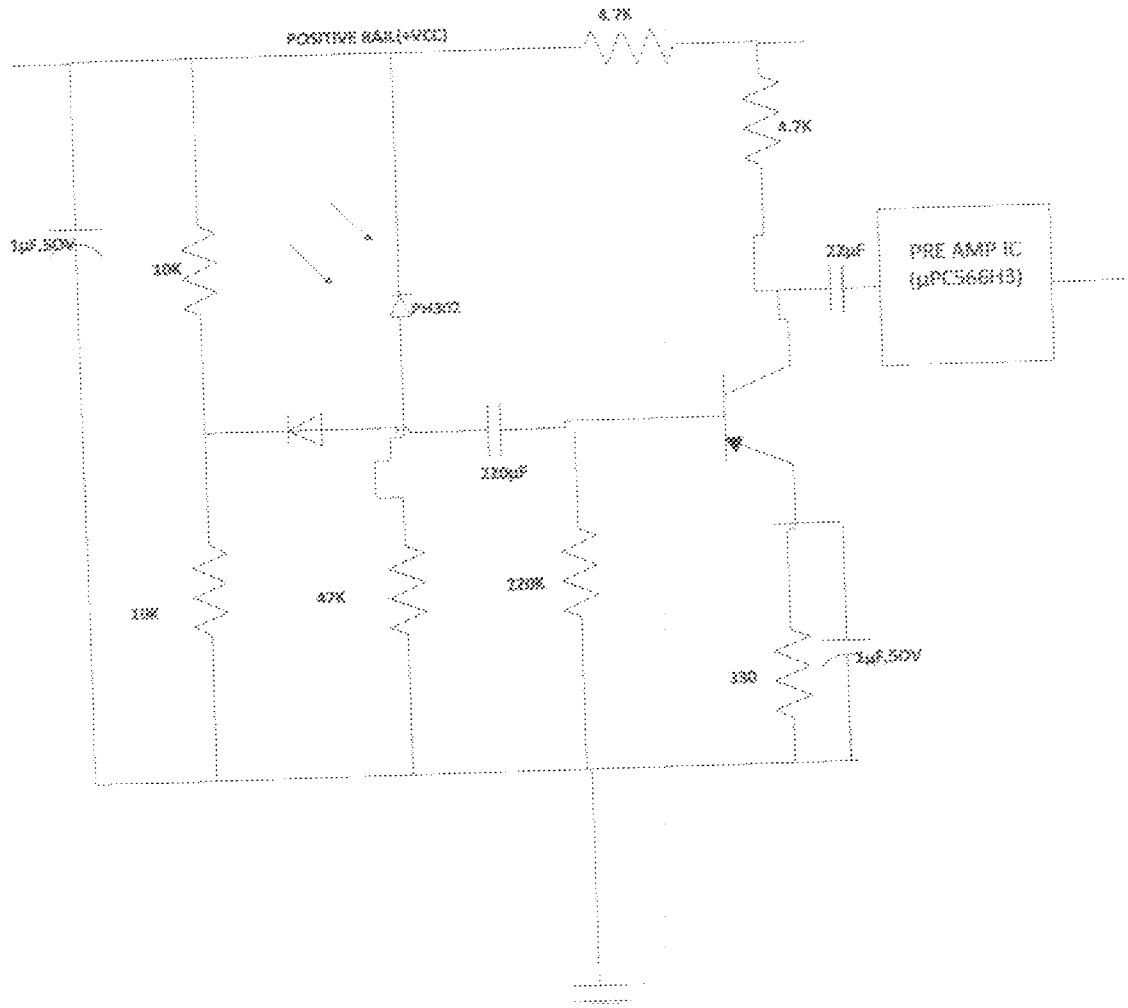

Fig 3.5 Decoder stage circuit diagram.

3.5. CONTROL UNIT.

This is made up of a microprocessor (M5848P) as shown below. It works on the basis of PCM code. The circuit uses an eight input multiplexer as part of it control sequencer that steps through seven steps, each of which actuate some physical process being controlled. It received the signal from the decoding stage, separate the signal from the carrier frequency to get the original ksignal back.

It take a look at the sequence at which the pulses where sent. Base on the sequence at which the sequence where sent , it compare it with the instruction settings by the microprocessor (M5848SP) and sent an output to a pre determine port which correspond to the sequence at which it was sent. So it determine the signal that will trigger the corresponding relay port. The connection of these unit is discribed with the circuit diagram in fig 3.5.

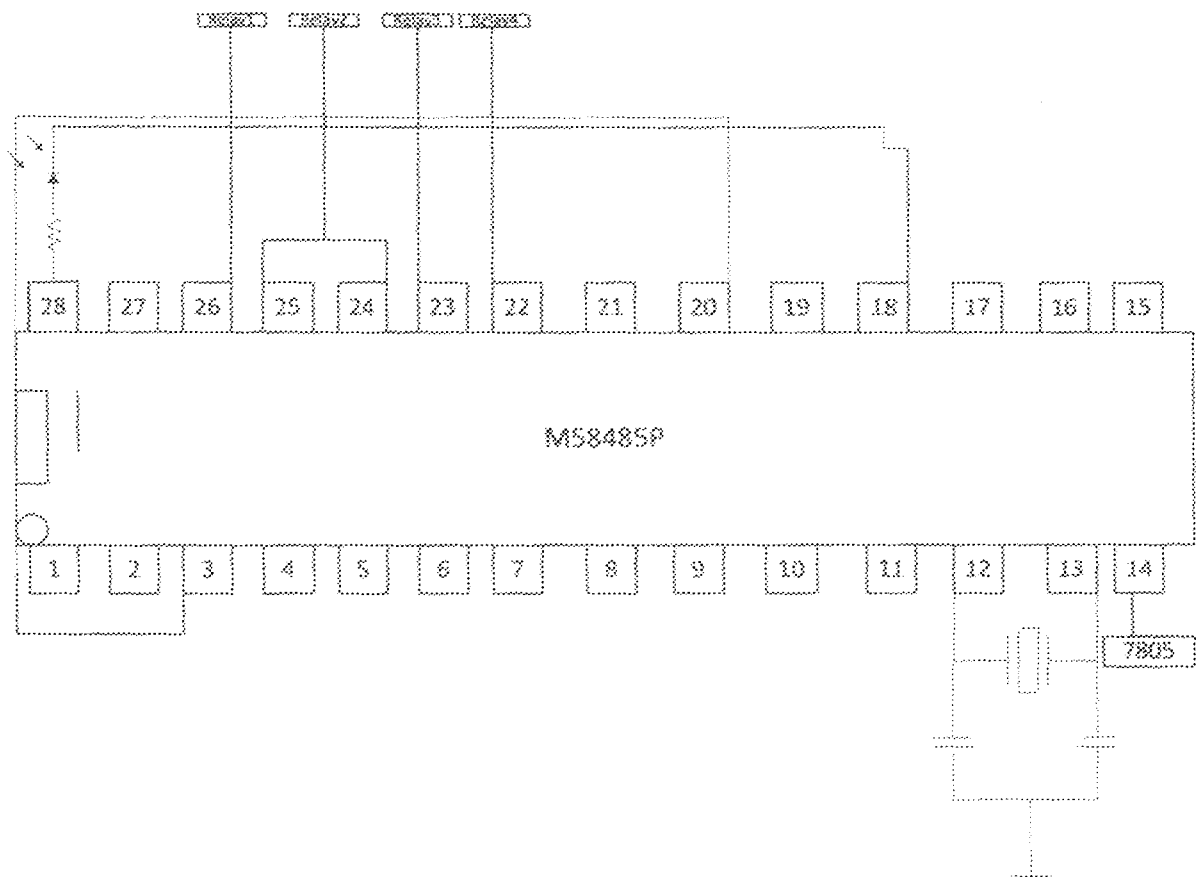

Fig 3.6 Control unit circuit diagram

3.6. RELAY AND MECHANISM UNIT.

This consists of four relays which are 6V, 10A in their ratings. They are electromechanical switches which are controlled by the transistor collector current. Whenever a high is at the base of the transistor, the transistor is never conducting since no current would pass through the transistor (that is, from emitter to the collector) for this reason, the relay remains inactive. The reverse becomes the case when logic 0 is inputted at the base. The relay then behaves in a manner that confirms Faradays law of electromagnetic induction thus performing its switching action.

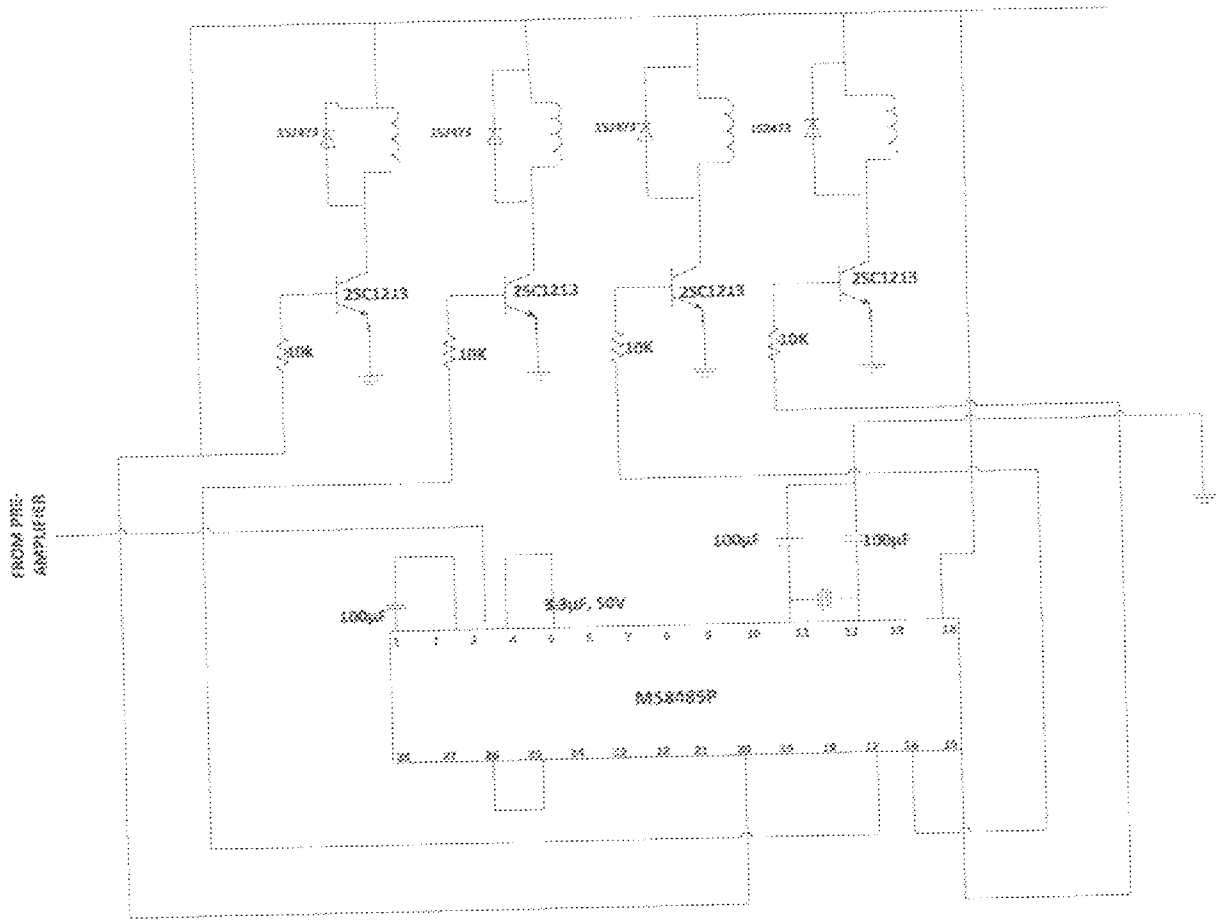

Fig 3.7 Relay and mechanism circuit diagram.

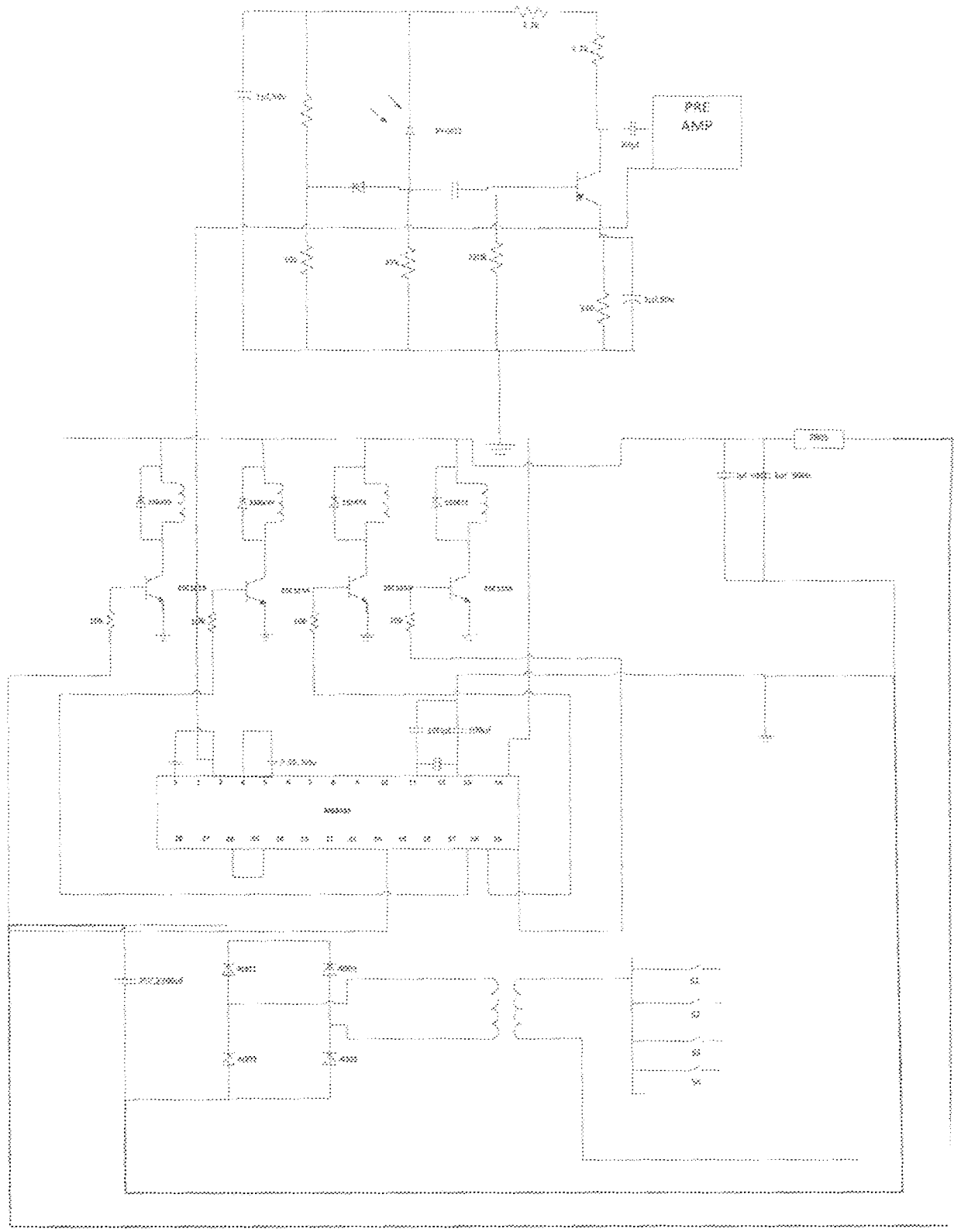

Fig 3.8 MAIN CIRCUIT DIAGRAM

CHAPTER FOUR

CONSTRUCTION AND TESTING.

This chapter contains the practical actualization of the project specification, in packaging testing and construction. It also discloses the shortcomings encountered during the course of the project along with the accurate solution.

4.1. CONSTRUCTION AND CASING.

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 30*cm* × 15*cm* 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.

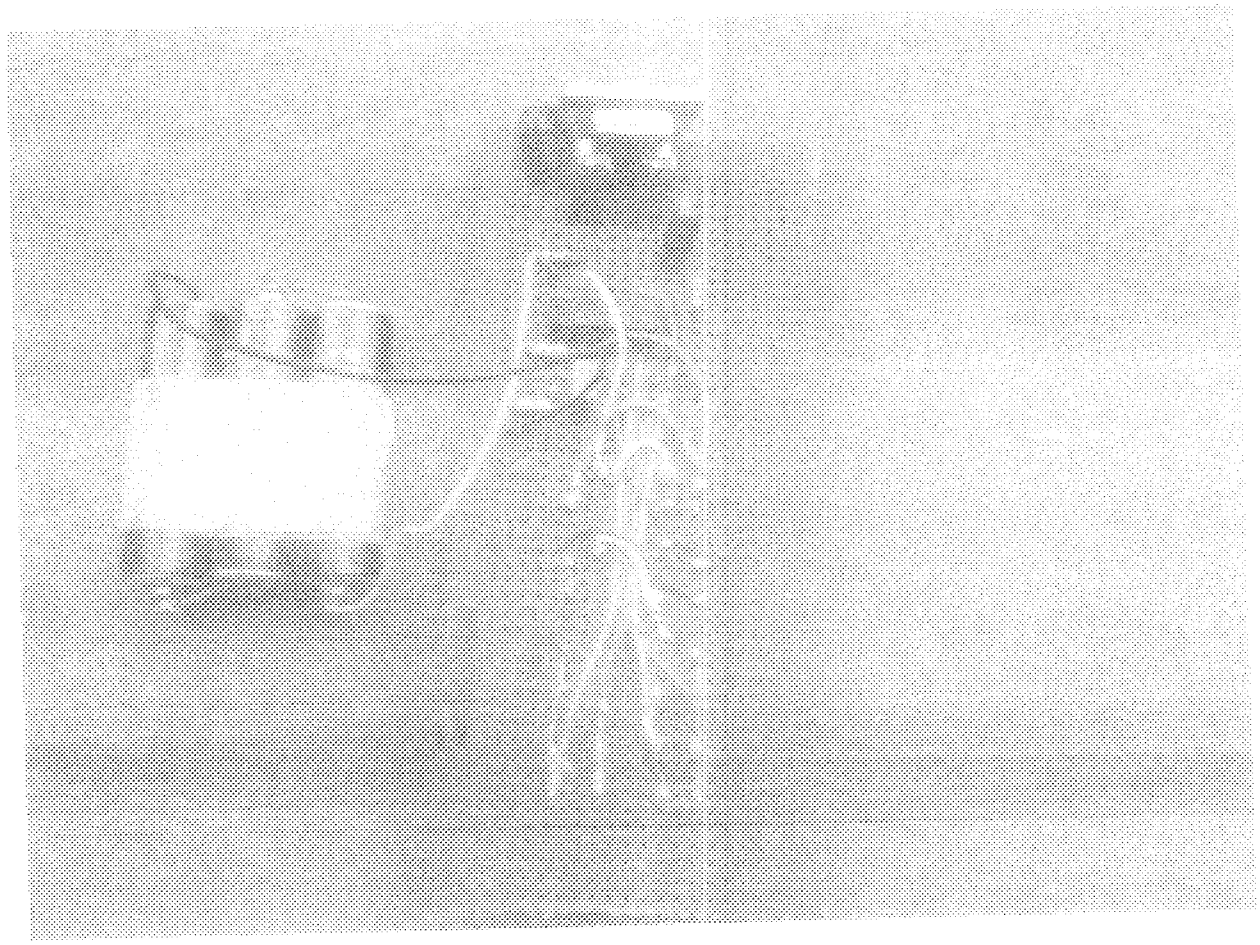

Fig 4.1 Transmitter circuit on veroboard

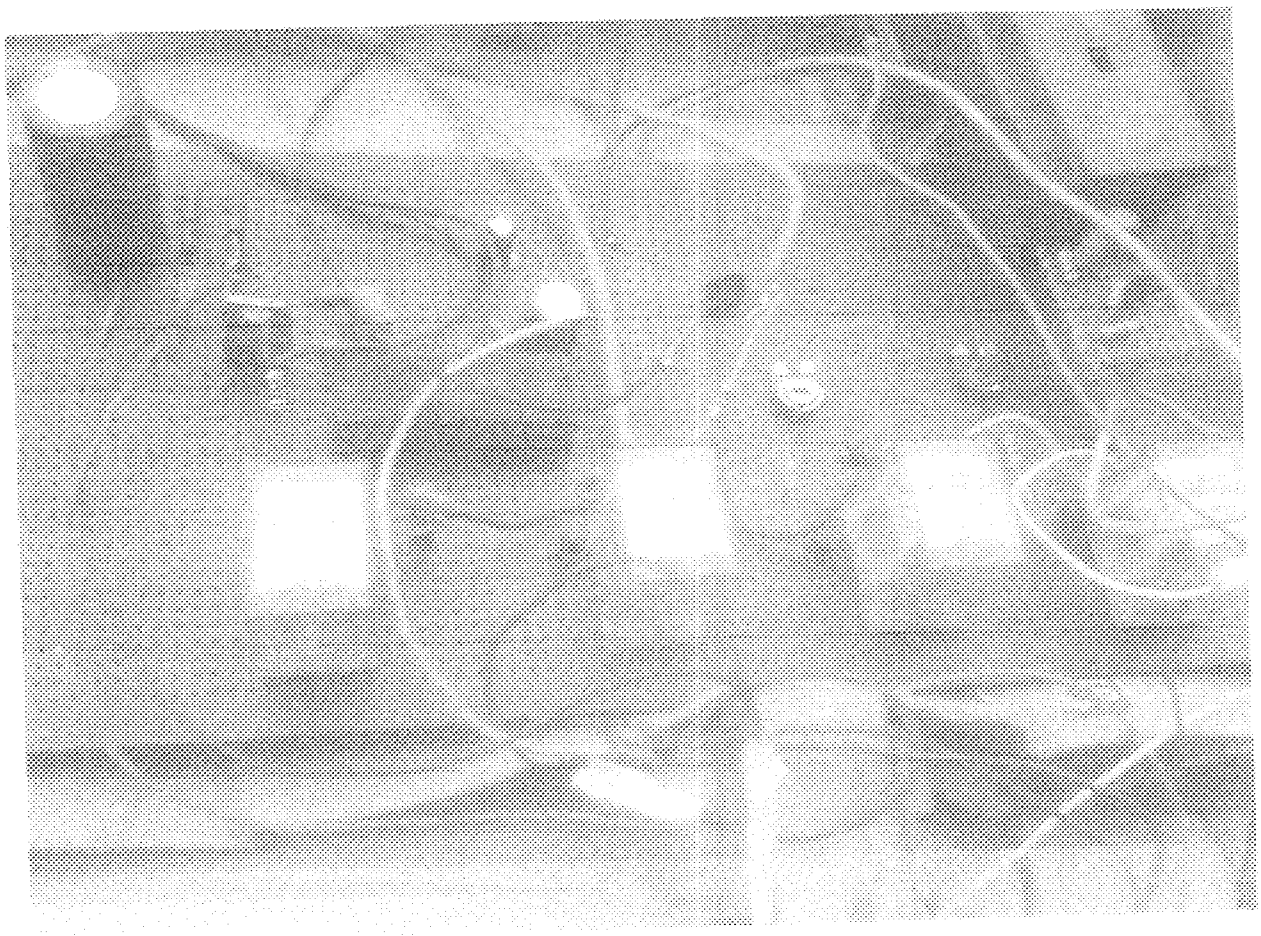

Fig 4.2 Reaceiver circuit on veroboard.

4.2. TESTS.

The operational performance of each individual unit was tested. All the units especially the power supply unit was tested and then the expected output voltage was achieved using multimeter.

Adequate tests were carried out on each stage of the project so as to see to the proper working condition of the devices. The table below summarizes the results obtained .

Table 4.0 Output from MS8485P microprocessor

A	B	C		LOAD 1	LOAD 2	LOAD 3	LOAD 4
0	0	0		0	0	0	0
0	0	1		1	0	0	1
0	1	0		1	0	1	0
0	1	1		0	0	0	0
1	0	0		1	1	0	0
1	0	1		0	0	0	0
1	1	0		0	0	0	0
1	1	1		0	0	0	0

The table above prove that the microprocessor (MS8485P) work with the principle of multiplexing. Therefore, from the test conducted, it was verified that the system is in good working condition.

4.3. PRECAUTIONS.

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

CHAPTER FIVE.

5.1. CONCLUSION.

The aims and objectives of design and construction of REMOTE CONTROL FOR MULTIPLE APPLIANCES have been achieved. A particular appliance can be operated conveniently without affecting the other appliances.

5.2. PROBLEMS FACED.

The power rating of the loads varies; thereby a high voltage rating relay will be required which is more difficult to power. It is not also easy to the get microprocessor (M58484P). Also, the use of microcontroller will be more preferable because of it flexibility in the programme, to control the hardware.

5.3. RECOMMENDATIONS.

Since the microprocessor (M58484P) has 30 difference functions, the circuit can be extended to accommodate more than two loads. It can also be achieved using common 8051 micro-controller.

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