Miniproject Report On

DTMF Teleswitch

CONTENTS

ABSTRACT

Today's busy world is an assemblage of many communication networks; some are yet to have their entries. The amazing thing is that these all are being used for various communication purposes only, though it is possible to extend their impacts in a variety of manner by the manifestation of interesting systems where we can directly have an aid from these. We are coming up with one of such interesting systems by which we can access even our bedroom electronic devices even from the most far off places in the world, provided the network under use has good range everywhere.

Here we are demonstrating a system namely RAN as an abbreviation for Remote Automation using Networks. In this most basic demonstration, the transmitter is chosen as a mobile phone and the decoding receiver as the land phone for convenience. One can have either two mobile phones or two land phones for the same purposes. To demonstrate such a system we will control, simply turning ON and OFF of four LEDs representing the actual devices, using any mobile phone from anywhere. Here we are designing such an electronic assemblage which can decode the signals from the mobile phone and can drive the four LEDs with the help of the BSNL network and the receiving land phone, representing the receiver section.

Such a system is really an asset for this busy modern world, where everything is being sought for automation…….

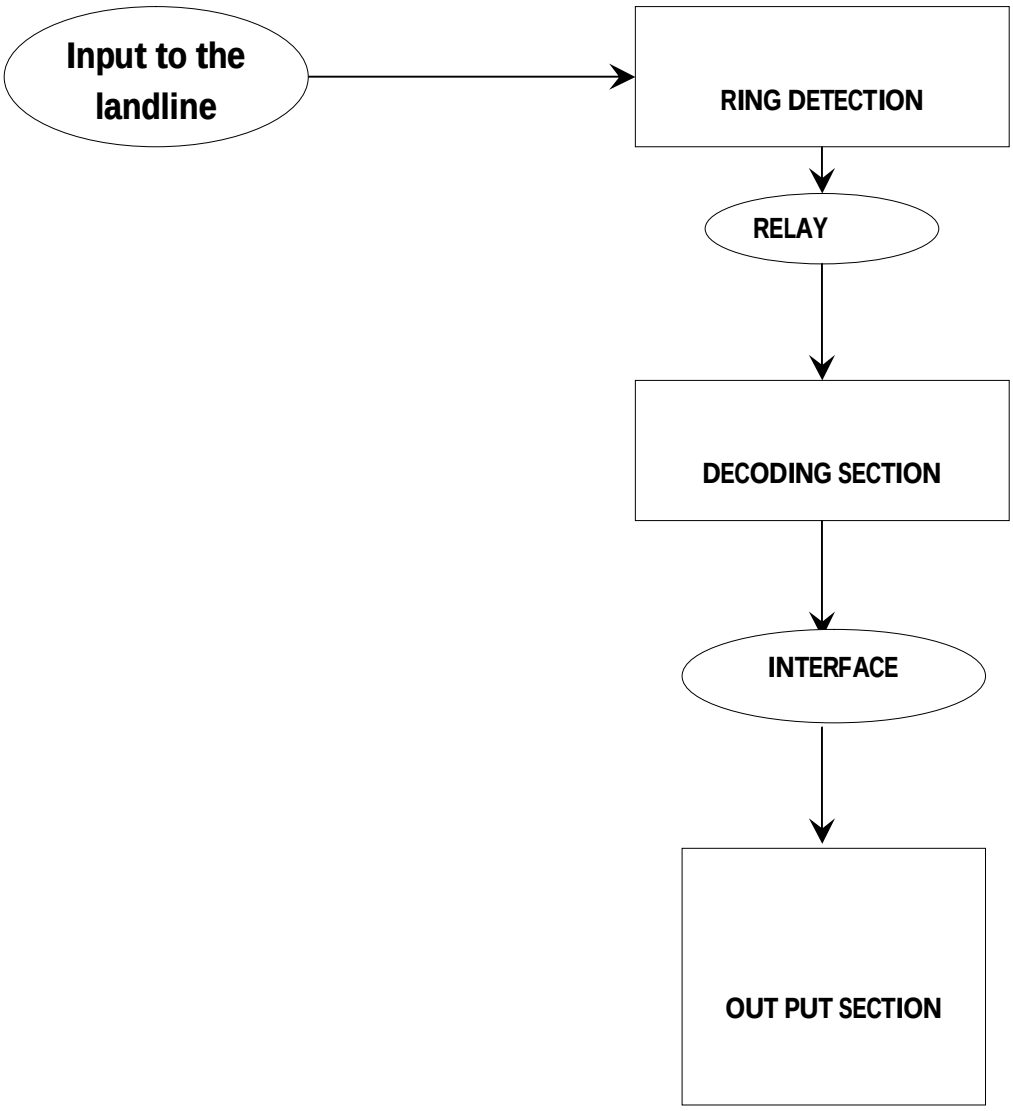
INTRODUCTION

Here we are restricting our discussion about RAN in the receiver section alone as the transmitting section is alike the common communication system with the only change that instead of a verbal message, a number (or numerical code) representing the code for a device to be controlled is transmitted. This code is decoded and used to drive the LED represented by the number using the receiver section.

The underlying principle mainly relies up on the ability of DTMF (Double Tune Multi Frequency) ICs to generate DTMF corresponding to a number or code in the number pad and to detect the same number or code from its corresponding DTMF. In detail, a DTMF generator generates two frequencies corresponding to a number or code in the number pad which will be transmitted through the communication networks, constituting the transmitter section which is simply equivalent to a mobile set. In the receiver part, the DTMF detector IC, for example IC MT 8870 detects the number or code represented by DTMF back, through the inspection of the two transmitted frequencies. The DTMF frequencies representing the number/ codes are shown below.

BLOCK DIAGRAM

As mentioned earlier, as the relevance of our design confines in the receiver section to drive the devices represented by the LEDs from the DTMF transmitted by the mobile phones to the land line, we are restricting our whole discussion therein.



CIRCUIT DESCRIPTION

Now let's have a detailed look into the whole circuit section wisely. Before getting in to the description, for the sake of easiness, let's confirm our aim or let's predict our expectation regarding its working.

We are supposed to send a code word from the mobile phone, which is the transmitter and is sending the corresponding DTMF frequencies along. At the receiver end, i.e. at the land line end we need to detect the code back using our circuitry and it is to be used for driving the devices, represented by the LEDs.

RING DETECTION_SECTION

Refer the circuit diagram of this section….Regarding the need of this section, we want to use this circuitry in the device mode i.e. to control the device's turn off and turn on while maintaining the normal functionality and usage of the land line to make and accept calls. So we must allow sometime for the land line to get into the off hook mode, also it is necessary to get the landline from on hook mode to off hook mode to enable the DTMF reception. If the land line is already in the off hook mode, then it won't be able to receive any signal as in the normal speech communication through networks. So using this section we are aiming to automatically activate our circuitry after a number of rings are heard from the landline, while the coupling for automation is done using a relay. Here we have designed such that the DTMF signals will automatically be coupled to the

Decoding section just after the 6th ring.

Now getting into the detailed analysis, the initial high ring voltage is coupled to a zener diode circuitry to reduce the voltage level for protection, at the same time maintaining the enough magnitude for detection using the opto-coupler. See the details in the circuit diagram. Whenever a ring occurs a sufficient amount of ring voltage is established across the inputs of the opto-coupler which causes the internal transistor to conduct and effectively the output 5th and 4th pin to get short. This results in an effective coupling of input ring voltage to pass through. Now we will exploit this signal to use it as a clock signal for the decade counter IC 4017, which will produce a high logic level at its Q5 pin upon reception of the 6th ring, which was changed into a quality clock signal. The diode-resistor-capacitor network along with the NAND gates of the IC 4093 is used to shape up the irregular voltage signal obtained at the output of the opto-coupler into a quality clock pulse for the IC 4017. Because of this, as mentioned earlier, just after the 6th ring the counter 4017 will produce a high level at the Q5 pin till the next clock occurs. This logic 1 level of Q5 pin is then used to drive the monostable multivibrator using 555 timer IC through BC 547 transistor coupling. The monostable multivibrator is designed for a period of about 60 seconds which is the allotted time for the operator to control the device using the palm device he has. Thus the monostable multivibrator will produce logic 1 level for a period of about 60 seconds at its output which is used to drive a relay as shown through transistor coupling, which will couple a low resistance in between the RING and the TIP terminals of the landline, resulting in the manifestation of a DC loop driving the landline from ON HOOK to OFF HOOK preparing the decoding section for the reliable reception of the signal transmitted from the mobile phone.

Now, we have to contend with a problem arising from the past counting of the IC 4017. Suppose a fellow called to our landline and cut the phone at the 4^{th} or 5^{th} ring. After this if somebody calls again then right at the first ring the landline will get into the OFF HOOK mode contrary to our expectation at the 6^{th} ring. How can we avoid this error? To solve this, what we have with us is only the RESET pin of IC 4017. So the solution is that we must reset the IC 4017 every time just after once the 6^{th} ring has occurred or the decoding section is coupled for decoding. So for this we use the retrigerrable monostable multivibrator using IC 74LS123 commonly called as the MISS-PULSE-DETECTOR. For this we supply the same clock pulse of 4017 to the IC74123, which has been designed for a period of more than twice as long as the duration of a single ring signal, which is about 5 seconds. The out put from the 4^{th} pin of IC 74123, which is the TOGGLED Q output, is then supplied to the active high RESET pin of IC 4017. Thus this arrangement will avoid the past counting nature of IC 4017 by resetting it just after the completion of the 6^{th} ring and the consequent coupling of the decoding section.

Now that we have effectively coupled the signals from the palm device to the decoding section, let's see how the decoding section performs the decoding function.

DECODING_ SECTION

Refer the circuit diagram of this section….when the 1k resistor is brought across the RING and TIP terminals the landline also brought to OFF HOOK mode so that the decoding section is now connected to the transmitted signal and can receive it.

The input capacitor-zener-resistor network is meant for both the protection of the DTMF decoder IC 8870 from comparatively higher ring voltage and the coupling of the signal to the same IC. Based on the reference DTMF frequencies the DTMF decoder IC 8870 decodes the binary equivalent of the keys or numbers in the number pad of the transmitting mobile phones. The decoding scenario of the IC 8870 can be consolidated as given below.

KEYS	Q4	Q3	Q2	Q1
1	Off	Off	Off	On
2	Off	Off	On	Off
3	Off	Off	On	On
4	Off	On	Off	Off
5	Off	On	Off	On
6	Off	On	On	Off
7	Off	On	On	On
8	On	Off	Off	Off
9	On	Off	Off	On
0	On	Off	On	Off
*	On	Off	On	On
#	On	On	Off	On

A	On	On	Off	On
B	On	On	On	Off
C	On	On	On	On
D	Off	Off	Off	Off

The output of the DTMF decoder IC 8870 is binary code, which is then fed to the binary to decimal decoder IC 74HC154 retrieving the original transmitted key or number. But the IC 74HC154 has active low output pins. So these active low outputs are converted to active high ones by passing them through NOT gates. Note that here we are using only five outputs of IC 74HC154 to control four devices represented by LEDs as an instance. Specifically the pins we are using are the 13th pin which produces an active low corresponding to the code *, the 2nd pin which produces an active low corresponding to the code 1, the 3rd one for the code 2, the 4th one for the code 3 and finally the 5th one for the code 4. Thus in the decoding section we retrieve back the same number or code transmitted from the mobile phone.

OUT PUT_ SECTION

Refer the circuit diagram of this section....using the converted active high outputs of the decoding section we are now supposed to control the TURN OFF and TURN ON of four LEDs. The output

corresponding to the code * from the decoding section is used to trigger a monostable circuitry in the output section, which is designed to produce a high pulse at it's output for a period of about 5 seconds. This high pulse with the duration of 5 seconds is used to activate the four tristate buffers i.e. the ICs 74LS126 enabling the coupling of the respective inputs of the buffers to their respective outputs. Now with in this 5 second duration we can have our control signals to pass through the buffers and can be used to control the D flip flops i.e. the ICs 74LS74, which has been set in the latching mode to get its output toggled upon receiving consequent clock pulses, thus triggering the turn ON and turn OFF of the devices once the same code is transmitted for a second time. In a nutshell, the latching mode operation of D flip flops causes a device to get turn on from off state or vice versa on reception of the code word. The IC 74LS74 is a positive edge triggered IC. One of the practical limitation we face here is to create a positive edge at the clock input of the D flip flop IC, using the isolated pulse coming through the buffer to its output. If we directly apply the pulse to the D flip flop to work in the latching mode it won't work due to the lack of establishment of the positive edge to its clock input, resulting from the occurrence of logic 1 level at the clock input of D flip flop right at the time of biasing or when connected to the power supply. For this purpose to create a positive edge going from logic 0 level to logic 1 level we pass the pulse coming out of the buffer through another NOT gate as shown.

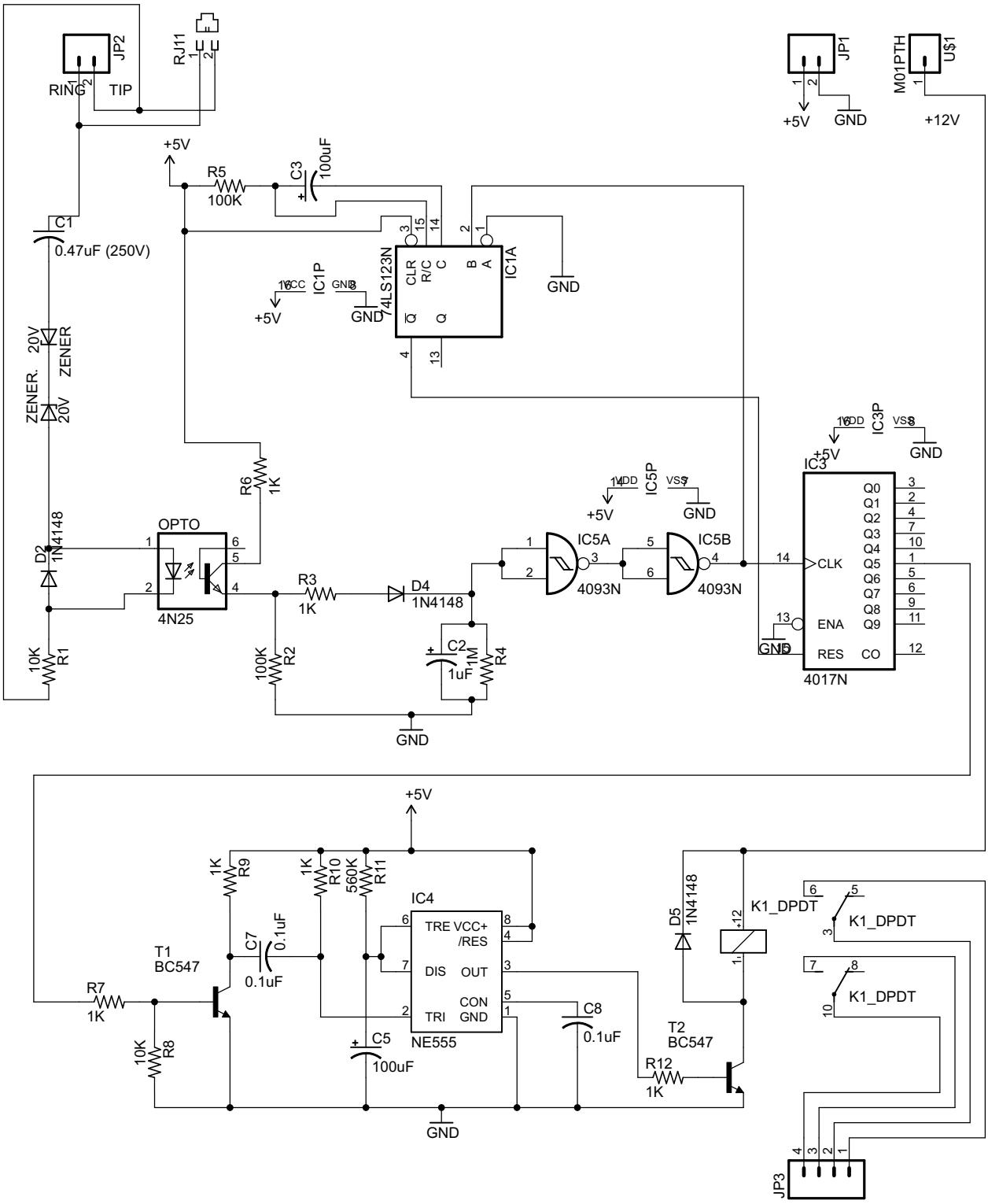
Finally, we need to find out a code which we have to transmit from the mobile phone so that we can establish a well shaped pulse as clock pulse at the clock input pin of the D flip flop for it to work in latching mode i.e. to get the LEDs turned on if they were in the off state and vice versa.

First of all we must activate the buffer in the output section for the predetermined time by triggering the monostable circuitry there in. So the first symbol in the code word should be *. Now, we need to transmit a high level through the activated buffer using another symbol specific to each of the device represented. From the circuit diagram we can see it can be 1 for the 1st device, 2 for the second one and so on. Thus by sending *(ordinal number of the device) we can create a low to high transition at the out of the buffer. But it's not yet been a well defined pulse with both trailing and falling edge. So to get a falling edge we should now send a symbol other than ordinal number of the device. Let it also be * to have a convenient code. Now, as we know we use * for triggering the monostable circuitry in the output section we must not end our code word with *. Other wise, it will cause the triggering input of the monostable multivibrator to continue in the logic 1 level even after the specified 5 seconds which in turn forces it not to get triggered for a second time on pressing * as there lacks the transition from low to high level at it's triggering input. Hence we must end our code word with a symbol other than both * and ordinal number of the device. Let it be 0. Thus, we got the code word that is to be send for our expected control as * ordinal number of the device*0. For example, to change the state of first device we have to send a code-*1*0, for the 2nd one *2*0 etc...

By following the similar logic, it is possible to find some other formats of code words. For example, the code word * ordinal number of the device 0 is also seeming to be worthy of.

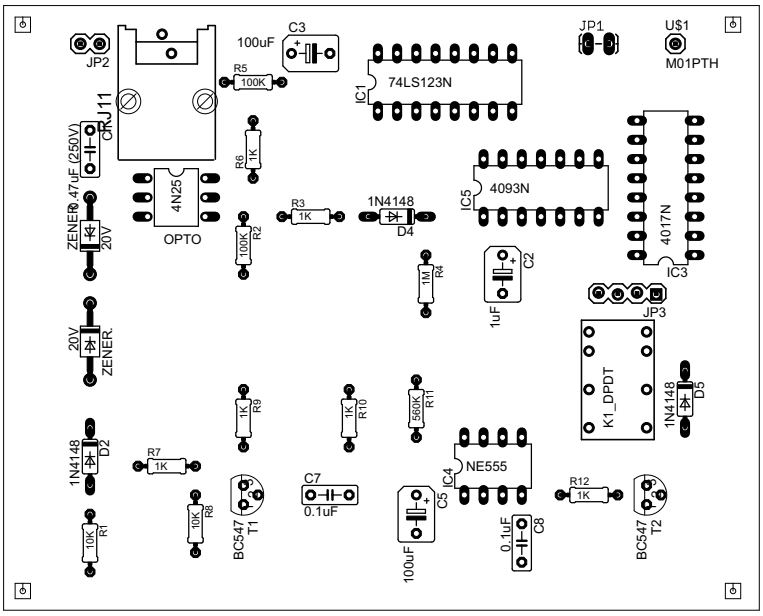
Thus the whole control procedure can be consolidated as first of all we need to make a call to the land line, just after the 6th ring it will automatically get on to the OFF HOOK mode for about 1minutes, during this time we can control the required devices with code words of specified format with in the installments of 5 seconds.

CIRCUIT DIAGRAMS (SCHEMATICS)

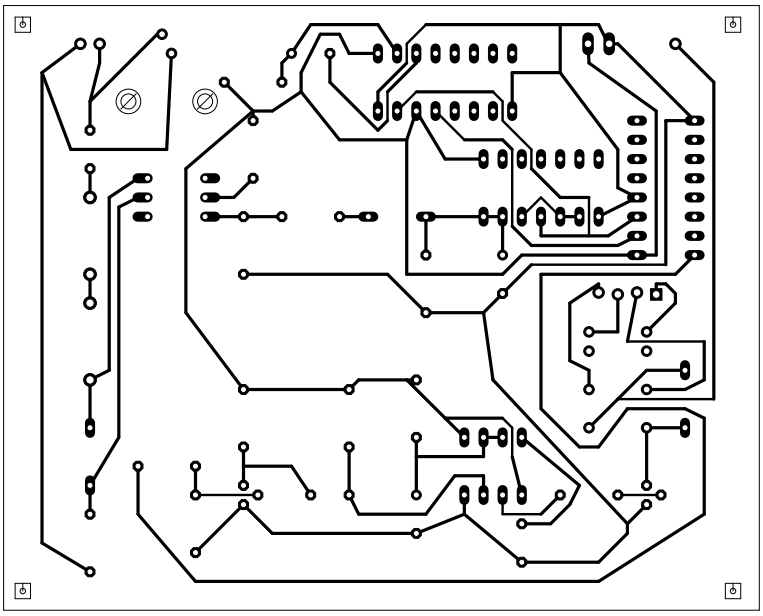


RING DETECTION _ SECTION

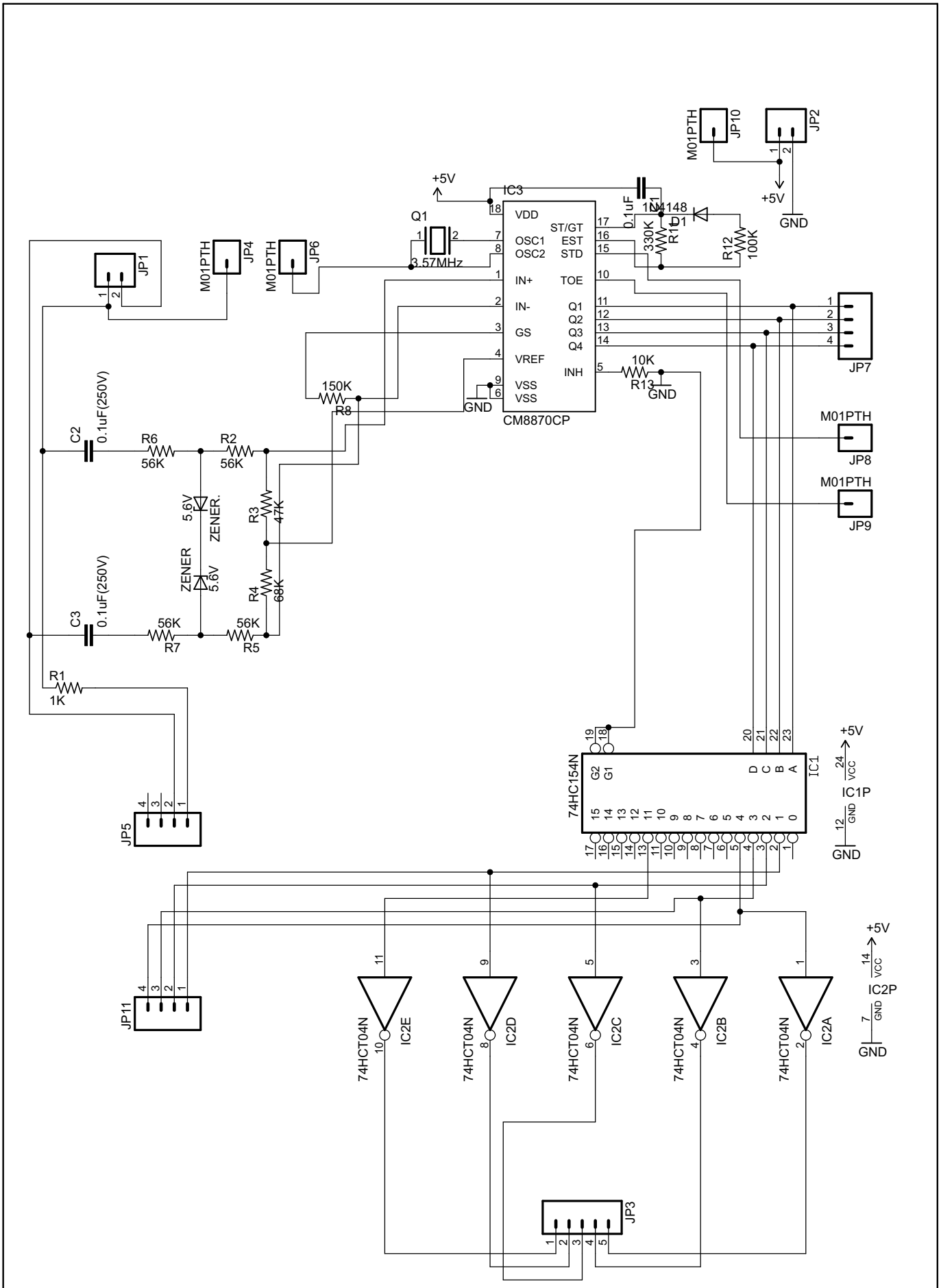
PCB LAYOUTS



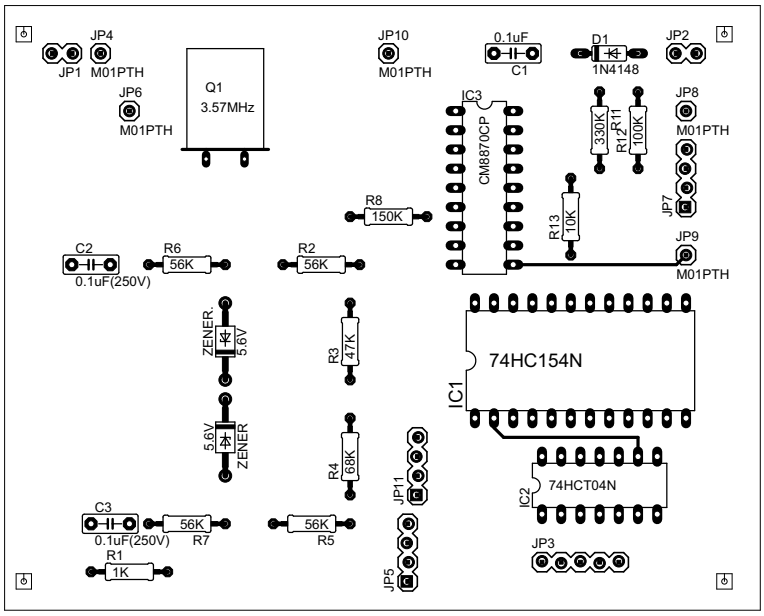
RING DETECTION SECTION_COMPONENT SIDE



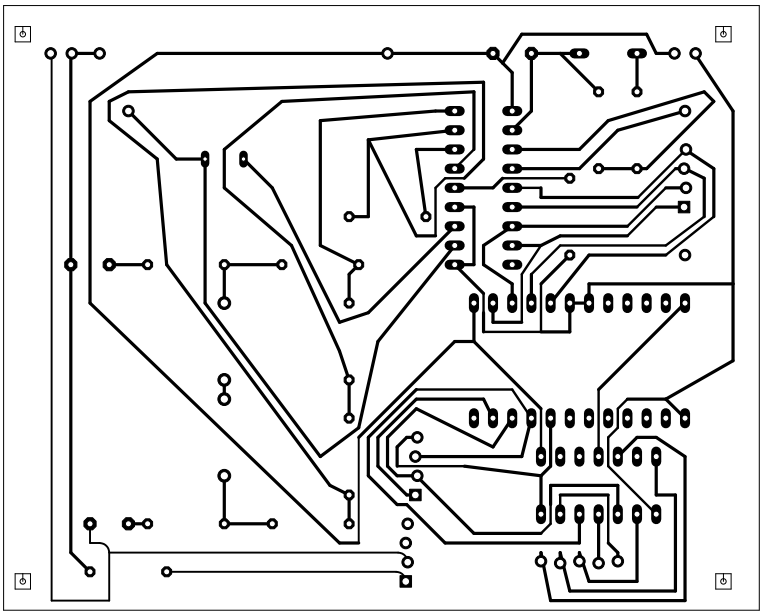
RING DETECTION SECTION_SOLDER SIDE



DECODING SECTION

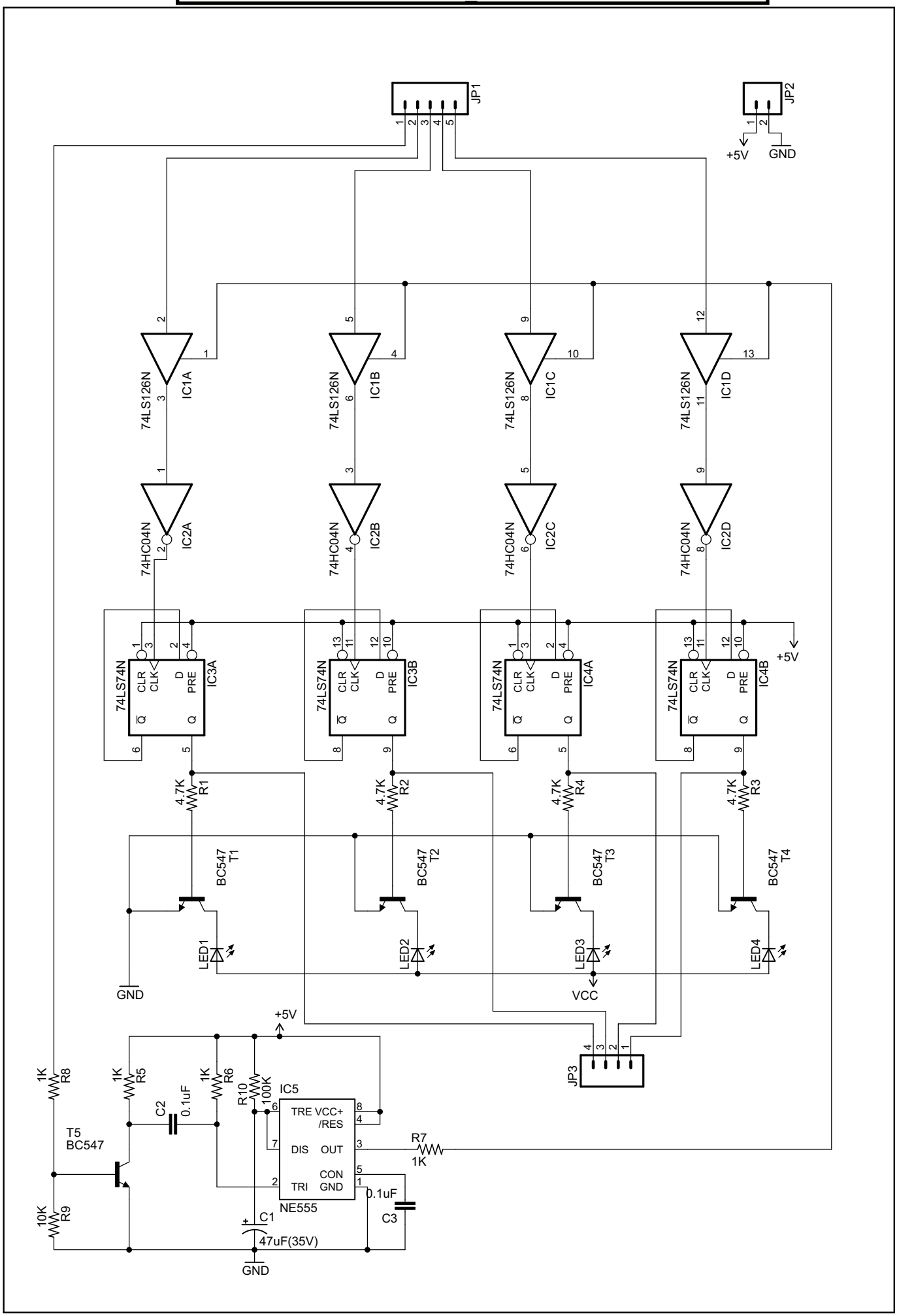


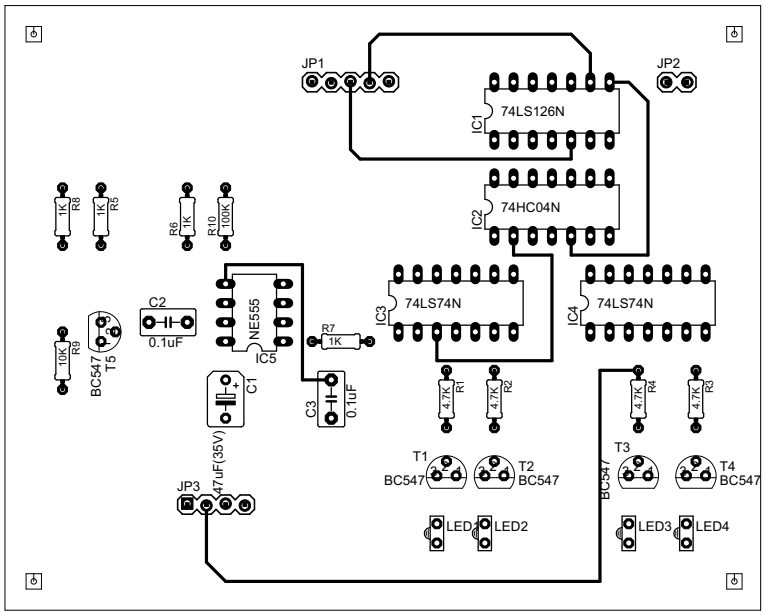
DECODING SECTION_COMPONENT SIDE



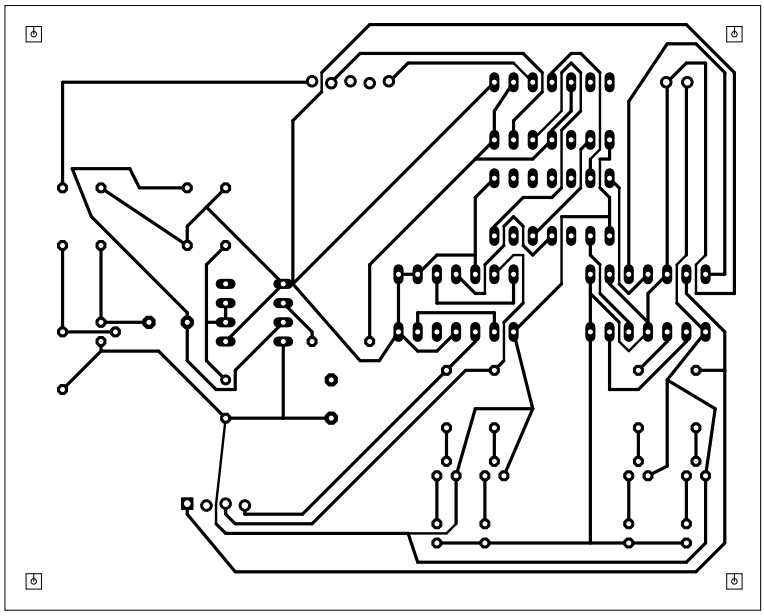
DECODING SECTION_SOLDER SIDE

OUTPUT_SECTION



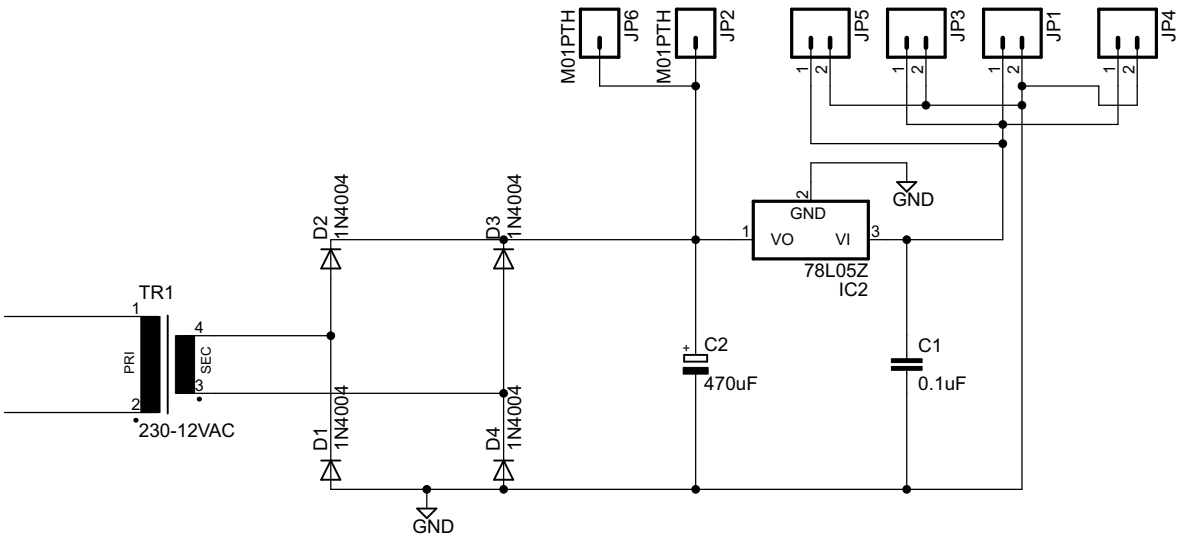


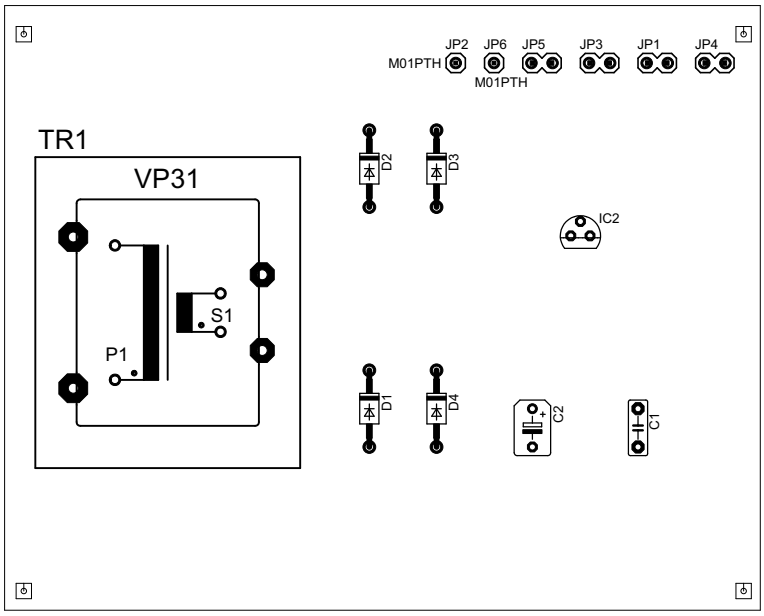
OUTPUT SECTION_COMPONENT SIDE



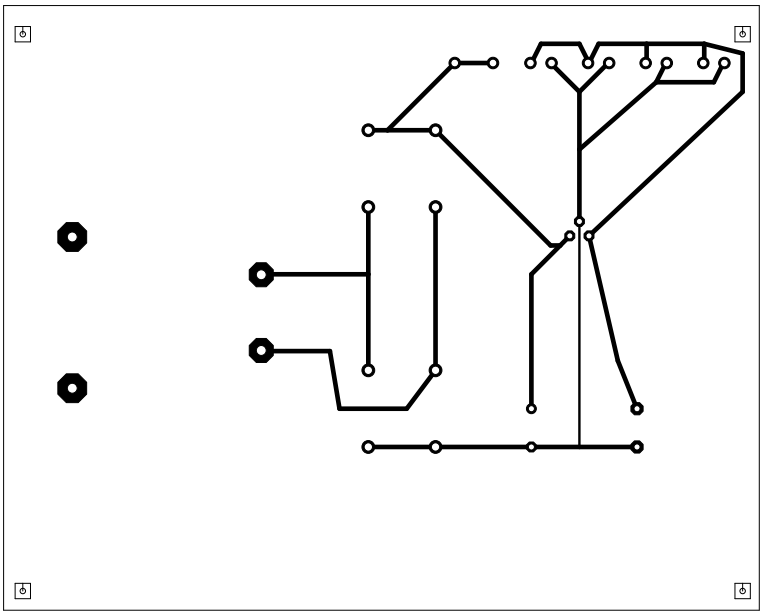
OUTPUT SECTION_SOLDER SIDE

POWER SUPPLY_SECTION





POWER SUPPLY SECTION_COMPONENT SIDE

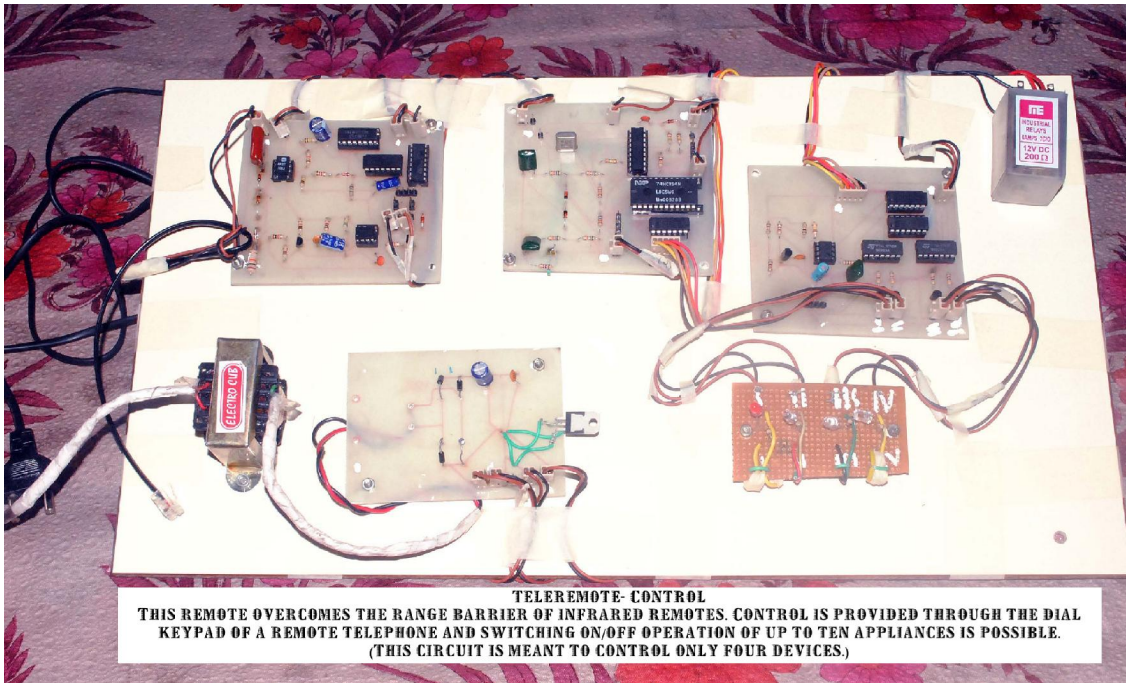


POWER SUPPLY SECTION_SOLDER SIDE

RESULTS AND CONCLUSIONS

The Remote Automation using Networks [RAN] on test performed exceptionally well to its capability and accuracy. All the inherent parts of the circuit performed consistently. It helped us to come out with good judgment. With the features what it inherits, it seems to be advantageous to the present era.

Final Implementation



TELEREMOTE- CONTROL
THIS REMOTE OVERCOMES THE RANGE BARRIER OF INFRARED REMOTES. CONTROL IS PROVIDED THROUGH THE DIAL KEYPAD OF A REMOTE TELEPHONE AND SWITCHING ON/OFF OPERATION OF UP TO TEN APPLIANCES IS POSSIBLE. (THIS CIRCUIT IS MEANT TO CONTROL ONLY FOUR DEVICES.)