

CONSTRUCTION OF FAX MACHINE SAFE GUARD

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ABSTRACT

We introduce a method of how an automatic system can be constructed with an individual parts of electronics components. An add-on circuit is constructed to interface with Fax- machine through telephone line. Capturing fax signal and delay timer operation control Fax-machine to automatically turn ON and OFF. Dividing sections will improve for learning this project. Basic Block diagrams are first introduced. The design and construction detail of the circuits are then explained. In delay timer section, we construct the delay timer using 555 Universal Timer in the form of monostable and the ON time (HIGH) state can be calculated from the relation $T=1.1RC$. Finally result and performance of the Fax-Guard are discussed including the suggestion for further relevant research works of Construction Automatic Systems.

Keyword: Phone line, Electromagnetic relay, Time dilation, Diode detector.

1. INTRODUCTION

Not only digital measuring and analog measuring instrument (such as voltmeter, frequency meter, timer, counter, inductance meter, resistance meter, thermometer, capacitance meter, etc.) but also automatic instruments (such as automatic door-bell, automatic thief alarm, automatic fire alarm, outdoor switches, automatic gear positioning system, automatic satellite searching system, etc.) takes essential role in electronic field and works. Digital instruments play today's importance role in many media.

A wide variety of real time control systems and data acquisition systems can be controlled and operate with the aid of Personal Computer acting as an artificial intelligence. Another wide variety of real time control systems and data acquisition can be controlled and operated with latest electronics called microcontrollers. Using microcontrollers, we can reduce many complicated circuits.

In analog circuits, the devices will construct with active components (such as diode, transistor, silicon controlled rectifier, operational amplifier, triac, etc.). This is also called traditional method, because it may involve the use of many components, many instruments or equipments. Our method also used traditional method. Although this traditional method is fairly complicated, its components can be easily achieved in market. We base on the monostable timer HIGH state with RC time relation $T=1.1R*C$, where T is the time we wish to operate the monostable multivibrator. 1.1 is constant and R is the resistor used in this timer and also C is polarized capacitor. We can easily set up our operation time using this relation. We should know only what is the maximum time taken that the fax signal transmitting.

The objective of this research work is to extend the application of automatic systems into the area of electronic instrumentation.

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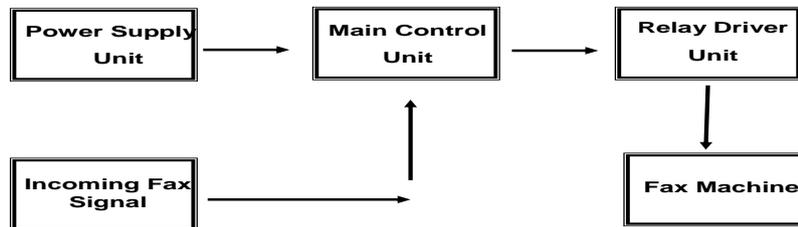
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2. BASIC BLOCK DIAGRAMS

Approaching the automatic system is not easy in practical. But if we know the problem, there must an answer. Requires are what we need, why we need, how we do, how to approach, how to solve the problem, what we know, how to apply electronic concepts.

Dividing sections is more easier to understand and more simple to operate the project.



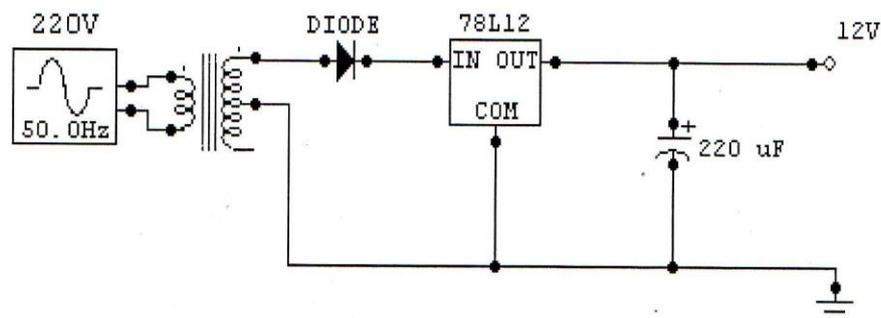
Under Controlled Device

Basic block diagram of automatic fax safe-guard system

Power supply unit distributes all the units if they need power required. Incoming Fax signal consists of detecting fax signal from the telephone line and then triggered to the main control unit. The main program include monostable multivibrator. This monostable multivibrator drives the relay driver section and the relay driver switch the output socket of fax-machine to turn ON or OFF.

3. EXPLANATION OF INDIVIDUAL CIRCUIT DIAGRAMS

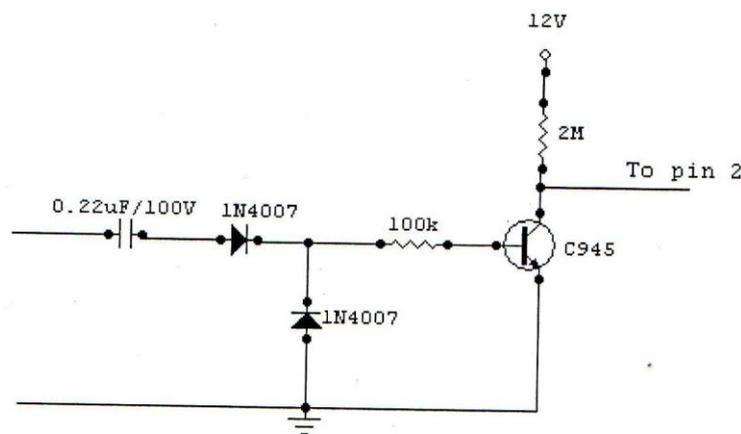
3.1 Power Supply Circuit



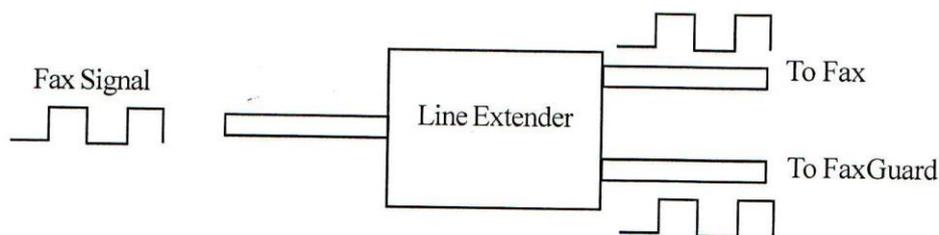
Power supply circuit

AC 220V/50Hz was reduced by Center tap Transformer T1 and Diode D1, 1N4007 rectifies the AC signal about 16V according to the formula $DC_{(out)}=1.414*AC_{(in)}$. When we get approximately 16V, we put this voltage to regulator IC 7812 to get regulated 12V. And then filter the DCV with C1, 220 μ F polarized capacitor to attain more precise DC value. Setting up the regulator IC means to get constant voltage source according to the load regulation. There are two types of regulation. They are line regulation and load regulation. Regulation of output voltage over a range of input voltage is called input or line regulation. Regulation of output voltage over a range of load currents is called load regulation. So we setup the regulator IC for load regulation. And then we can distribute the power for the whole project units.

3.2 Signal Detector Circuit



Signal Detector Circuit

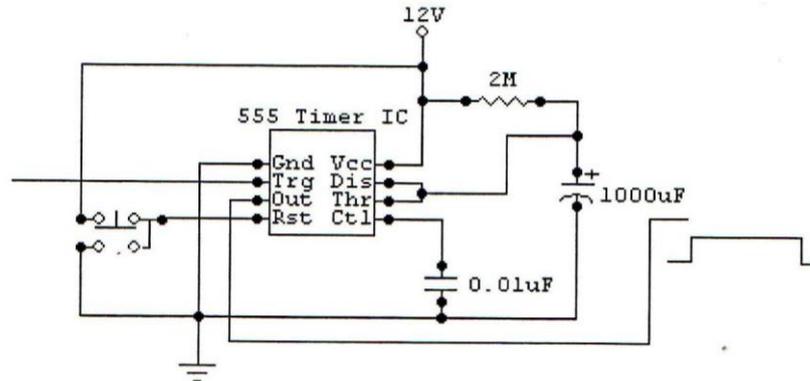


Splitting fax signal into two parts

Signal detector circuit detects the incoming fax signals. When the fax signal is coming, the non-polarized capacitor 0.22 μ F/100V keeps the fax signal and the signal is approximately about AC54V. The two 1N4007 rectifier diodes convert this AC signal to DC signal. This signal voltage is a little high voltage for the transistor Q1 C945. So we reduce the dropper resistor about 100k Ω . The transistor is cutoff in normal condition. When the fax signal is coming or the base terminal of the transistor

gets about 0.7V, the transistor is in saturation condition means the transistor pulls down the collector current to ground. So we trigger the monostable multivibrator for 555 timer IC by pull down the pin No.2 to ground. Otherwise we put the 555 timer IC pin No. 2 to negative going pulse. By this mean, we can construct the signal detector circuit.

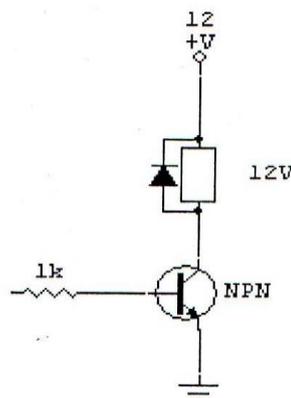
3.3 Monostable Circuit



Monostable circuit

There are three types of multivibrator. They are astable multi-vibrator, mono-stable multivibrator, bi-stable multivibrator. In our project, we use the monostable multivibrator using the 555 universal timer IC. Figure shows the monostable multivibrator. Pin No.4 for reset. According to the time constant setting, this will stay on HIGH state about $1.1 RC$. So $1.1 * 2 \times 10^6 * 220 \times 10^{-6}$, 484 seconds approximately equal to 8minutes. We can adjust by replacing the values of resistor and capacitor as we need time expansion or operating time. When the HIGH state finished, it will go to the LOW state and easily can be seen in wave form at above figure. When the timer is on HIGH state, it's signal will drive the Relay driver and when it's LOW time it will turn off the relay driver. The relay driver drives the Fax machine. The 555 timer IC is well known over the world and can get easily and cheaply in the market.

3.4 Relay Driver Circuit



Relay driver circuit

A relay is a relatively simple electromagnetic device. It may consist of a coil, a ferromagnetic core, and a movable armature on which make and break contacts are fastened. The following figure illustrates a relay used to close a circuit when the coil is energized. It is known as single pole single throw (SPST) also see in fixed complete circuit diagram. When signal from monostable is coming through resistor 1K, the transistor acts as a saturate and pull down the 12V to Ground through relay.

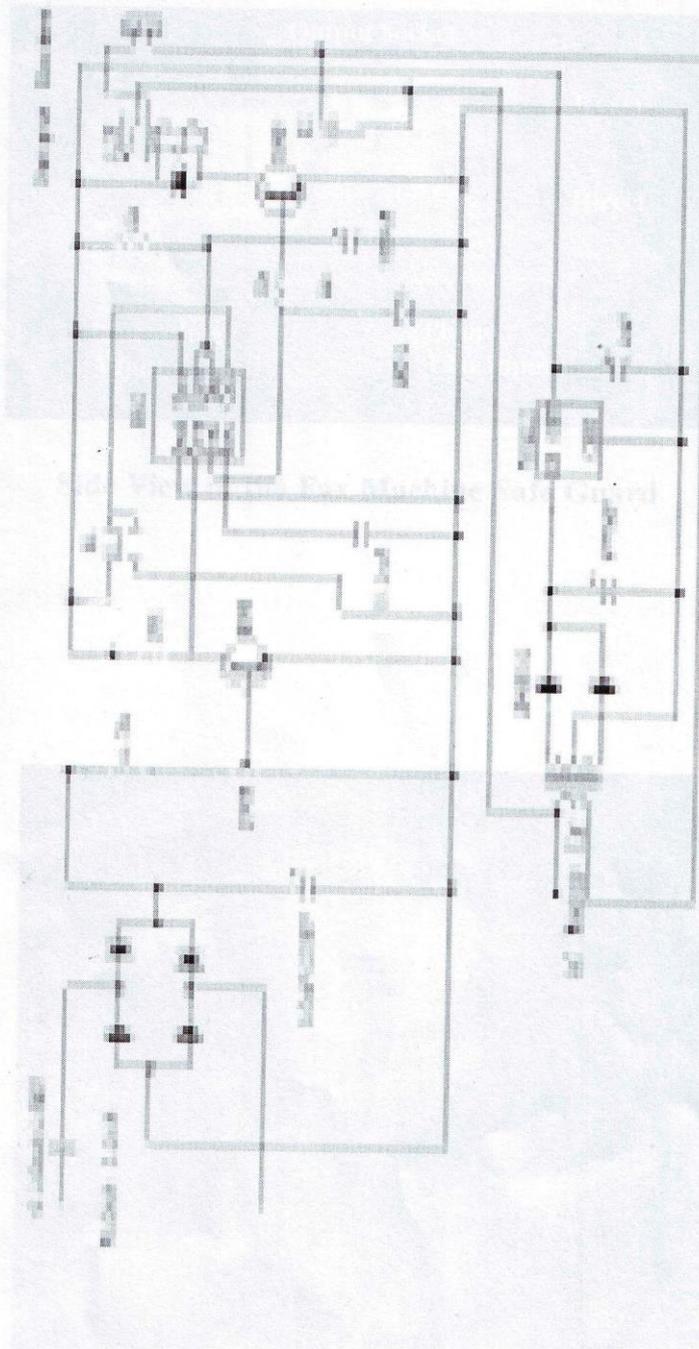
4. RESULT AND DISCUSSION

In this section, we will explain result, experience and discussion. To attain more reliable and accuracy, the RC time constant should be more precisely. Most of the fixed resistors and capacitors have tolerance $\pm 5\%$ accuracy. We should measure with reliable meters. In our project, we convert phone signal AC to DC 1voltage. According to the experiments, we shouldn't directly connect the phone line to use. So we connect 0.22 μ F non-polarized capacitor in series. If we use phone signal to direct use by connecting the rectifier diodes, the telephone can't call from the other side.

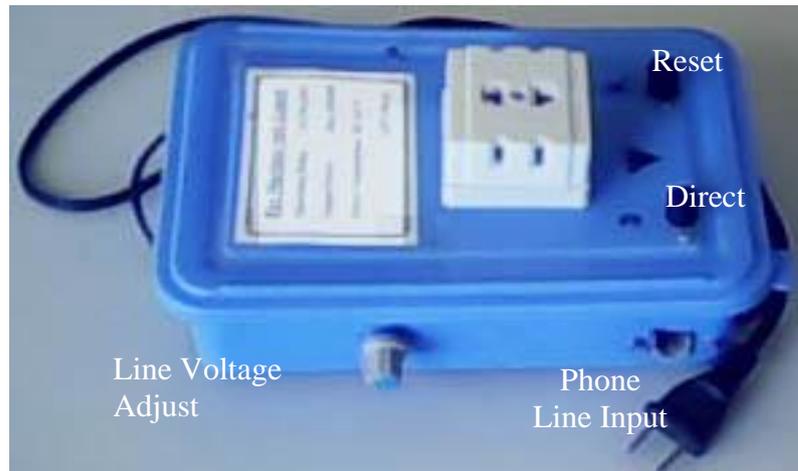
Another fixing experience is that we saw typical phone signal's amplitude is up to 90V. But some signal's amplitude (e.g. Telephone extension operator) is round about 70 V. This may cause a problem in circuit according to Ohm's Law, $V=IR$. So we fixed this problem with potentiometer to adjust the signal. The fixed and completed circuit of this project is given in next page.

Another suggestion to accurate for this project, we should use PIC (Peripheral Interface Control) or microcontroller base electronics. If we use PIC microcontroller, we can easy adjust the sampling time. As soon as after receiving the fax signal, fax guard will automatically turn off the fax machine. But it is expansive for this safe guard comparing with the active devices. The devices we use in this project can easily achieve in the market with reliable costs. Power consumption is only 0.5watt. So we can take conclusion this will give less power consumption and we can reduce the power loss. We can also avoid the damage of the machine due to the electric spikes and main regulations.

(i) Fixed complete circuit diagram



(ii) Design & Construction Images



Side view of the fax machine safe guard



Perspective view of the fax machine safe guard



Internal circuitry array of electronic components

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