

Build Your Own Voice Recognition Alarm System

We live in an age of rapidly changing technology. This has its good and bad points. For example, most vehicles have an alarm system installed. Many are quite sophisticated and include proximity detectors to check if someone is 'close enough' to be a threat. They'll usually 'talk to you' to let you know this as well. Some of these systems use a 32-bit or higher security code to 'disable' the system before entering or 'enable' the system after leaving by using a key chain transmitter. And it's not very 'fool-proof' either.

These key chain transmitters generate a 'signal' which can be picked up by a nearby scanner. That means that the signal can be captured and duplicated and, for all intents and purposes, the alarm system is defeated. Or, they might use a digital sequence generator which generates all the security codes in sequence. All someone has to do is run the generator nearby and wait until your system 'beeps' to indicate it's been disarmed!

One of the more interesting ways to take care of this problem is a Voice Recognition (or VR) system to take care of the 'enable' and 'disable' features required of an alarm system. What follows is a universal VR alarm system which recognizes up to three separate voices and provides a full range of options for the most discriminating user.

Desired Features

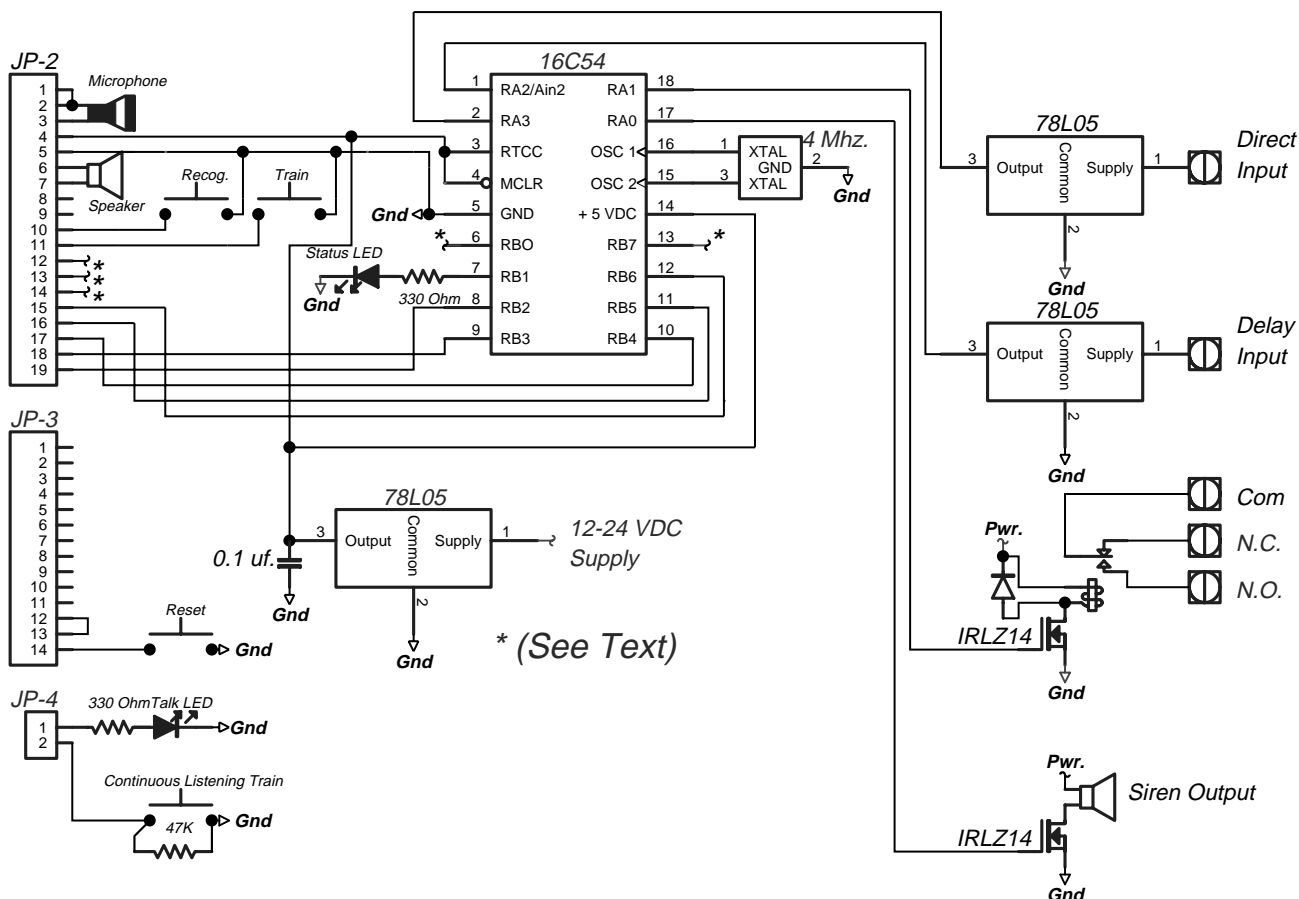
In order to make an alarm system 'universal,' certain features must be present. These include an LED output which indicates the status of the system. Another feature is an output for alarm condition (our system has two), a discrete output which is on until reset, and a digitally generated audio siren. Depending on the speaker impedance and the power supply voltage, the system can be heard for blocks! We'll cover this more in detail with the actual circuit description.

In addition, since we're NOT using the decoded outputs for outputs 1-3, they're available for momentary 'high' outputs of 1 second duration each. Gateway word '1' will activate output '1,' gateway word '2' will activate output '2,' and so on. Use a HEXFET as we did in the relay output and you can control whatever you like. Or, you might use the output to activate a one shot timer using a 555 chip and use it to turn on the lights outside your office so you can unlock the door.

The last output option is using output '4' to TOGGLE RB.0 and output '5' to TOGGLE RB.7. Quite simply, this means that each time the respective command is recognized, the output will change states. On start-up, both outputs will be off. The first command will turn it ON, the next command will turn it OFF, and

Continuous Listening Voice Recognition Alarm System

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so on. For increased versatility, these two commands are only available when the system is disarmed. The reasoning behind this is simple – when the system is armed, you only want access to the alarm system controls itself.

Now for inputs. We have two simple options available. An immediate alarm contact and a 30-second time-delayed contact. The latter allows you to enter a 'protected' area to 'disable' the system without an alarm. Since the inputs are fail-safe because they are enabled high, you can put as many sets of normally-closed contacts in series to protect as many areas as you wish. As you can see, this simple – but effective – arrangement has lots of different applications in many situations. We think you'll find it's just what you're

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looking for.

Circuit Description

The VR Security System is based on a Sensory VD364 continuous listening mode VR module which has been configured for a three-gateway word mode of operation. Each channel has five output commands available, which will be discussed in detail later in the article. Sensory's website at <http://www.sensoryinc.com> contains all the documentation so we won't repeat it here.

The VR module is interfaced to a PIC 16C54 microcontroller chip which has 12 I/O lines. Five lines are used for interfacing and the other seven lines take care of the system input and output options. You've got a myriad of options available to you, including programming in three different languages if you like! The HEXFET transistors are used for high-current switching of the output options as noted. If these options aren't required, simply eliminate the transistor for that option.

The digitally-generated siren output is fed to an ultra-low (0.2 Ohm) HEXFET switching transistor which is rated at 60 VDC and 40 amps in the pulsed mode of operation. By using Watts law and not exceeding a low resistance value of two ohms, you can generate up to 1800 watts of peak power! Don't forget a massive fan-cooled heatsink at this power rating, however. The rest of the system is relatively straightforward. We'll cover it in more detail in the set-up procedure.

Voice Commands

Here's where it gets real interesting. We'll break the commands down in generic terms and then discuss each one's function in detail. They are, in order:

Command #	Function
1	Arm The System
2	Disarm The System
3	Silent Alarm Mode
4	Toggle RB.0
5	Toggle RB.7

Arming the system allows each of the inputs to control both outputs according to the following logic. The direct input MUST be high to enable the system before the PIC will respond to the VR module output. The LED will illuminate when this input is high. Please note that the VR module will 'initiate' the commands with the Delay Input low. Obviously, this feature lets you enable the system within a protected area (your car, for example) and then leave and secure the area (delay input becomes high) before the 30 seconds times out.

Normal Mode

If we select Command 1, the LED will be on continuously for 30 seconds and then the LED will flash on and off at a 1-Hz rate. This 30-second interval is the 'arming' mode of operation. A low input on the Direct Input during this time will immediately cause the system to go into alarm. Once an alarm has occurred, the siren will cycle on and

off for 30-second intervals. The relay output will be on continuously, though.

A low input on the Delay Input will cause the LED to extinguish immediately. You have entered the 'tripped' mode of operation and now have 30 seconds to enter the protected area and disable the system using Command 2. If you don't, then the outputs will go into 'alarm' mode as mentioned above. A Direct Input going low at any time during this interval will cause an 'alarm' mode, as well. Basically, the Direct Input is used to control the system from outside of the protected area and the Delayed Input is used to control the system from within the protected area.

Silent Mode

If we select Command 3, the LED will 'flicker' rapidly and the inputs will work identically, but the siren output is disabled. This gives you the option to produce 'silent' alarms. The LED will show an 'alarm' mode by remaining extinguished. The relay output can be linked to an Autodialer (such as we have on our website) to call the police, for example. Using Command 2, you can disarm the system anytime before an alarm occurs. The LED will be extinguished in this mode.

Resetting the System

It should be easy to understand that the purpose of the silent period is to let the system recognize your voice using Command 2 to reset the

system. Can you imagine how hard it would be for the system to understand you with the siren blasting away in the background! Yes, we tried to think of everything. And speaking of everything, we've got two undedicated outputs for you to use anyway you like.

A Nice Extra Feature

RB.0 is controlled solely by Command 4 and RB.7 is controlled solely by Command 5. These outputs operate completely independently of the alarm system commands. It has no effect whatsoever on either LED, either. The outputs are TOGGLED (change states) each time the appropriate command is recognized.

Let's say, for example, you use one of the outputs to control a relay which interrupts the wiring to the starter on your car. That way, you can disable the starter, enable the alarm, and leave the car. Then, when you return, you can disable the alarm and then enable the starter.

I think it would be pretty hard for anyone to bypass this nor would they waste their time trying. The alarm will probably scare them off long before they figure out something else needs to be done. And that, of course, is the whole idea of any alarm system!

Programming the System

The module is wired a little differently than the Voice Recognition X-10 Control System featured in the December 2000 issue of Nuts & Volts. This is because we're using three different 'gateway' words with

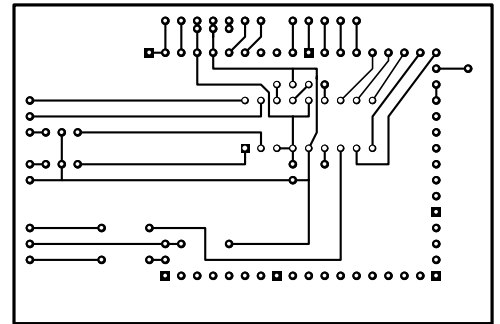
five commands apiece. Each of the five commands is identical in function even though you could use different words or even different languages!

Basically, the 'gateway' word could be as simple as your name, for example. Or, as sophisticated as any 2-1/2 second phrase of your choosing! By the way, this 2-1/2 second interval is available for all 'gateway' and command words.

Once the unit is assembled, we're ready to set it up for proper operation. On power up, the speaker will beep once to let you know the VoiceDirect module is okay. The talk LED will flash but extinguish if no training has occurred. Pressing the CL train (continuous listening mode) button will prompt you to say "word 1" and repeat it a second time. It will also tell you if it got it right, or if it didn't, and even why it didn't! Once you have trained your 'gateway' word, you're ready to train each of the five commands per 'gateway' word.

Each individual command is set up using the train (non-CL) button. It needs to be pressed for each word because the system doesn't know beforehand how many commands it will be responding to. And it has to be completed for each of the three 'gateway' words in sequence. It will prompt you to say 'word 1-1.' This will continue through 'word 1-5.' Then it's time to train the second 'gateway' word, and so on.

Once training is complete, you can put the system into operation by pressing the recognize button. At that time, the talk LED will light indicating the system has entered the continuous listening mode. This LED is



PCB Layout

*See note above

NOT to be confused with the status LED, which indicates alarm status. The VR module LED is an indicator for voice recognition only.

Pressing either the recognize button or CL train button will extinguish the LED and take the system out of listening mode. The system can be erased by holding down BOTH the train and recognize buttons together for at least one second. The system will respond with "memory erased." There's lots of other prompts like "spoke too soon," "similar to previous word," "please talk louder." Once again, it's all covered in the documentation which is available on Sensory's website.

In operation, the talk LED is lit and will flash to let you know it's recognized the proper 'gateway' word. If it recognizes the next word as well, the appropriate command is sent. It will also tell you which command number was sent. If not, the unit has to recognize the 'gateway' word again before it will recognize another command.

We haven't gone into every detail in construction and use on purpose. That's entirely up to you. Please note that we didn't include layout on the PCB for the relays or HEXFET transistors. That was done deliberately to give you the greatest amount of flexibility, depending on what options you want to use. That pretty well sums it up. **NV**

Voice Recognition Alarm System-Parts List

C1	0.1 uf. 50 WVDC monolithic capacitor-Radio Shack # 272-109 or equal
*CR1	4.00 Mhz. Ceramic Resonator-Digikey # PX400-ND or equal
*IC1	Microchip Technology PIC 16C54-XT/P microcontroller Digikey # PIC 16C54-XT/P-ND (requires programming)
JP-x	see below
LED1	T1¾ Green LED-Radio Shack # 276-022 or equal
LED2	T1¾ Green LED-Radio Shack # 276-022 or equal
MIC1	Omnidirectional Electret microphone element-Radio Shack # 270-092 or equal
PS1	Power supply 9-24 VDC 100 ma. Output-Radio Shack # 273-1767 or equal
R1	330 Ohm ¼ w. 5% carbon resistor-Radio Shack # 271-1315 or equal
R2	330 Ohm ¼ w. 5% carbon resistor-Radio Shack # 271-1315 or equal
R3	47K Ohm ¼ w. 5% carbon resistor-Radio Shack # 271-1342 or equal
S1-S4	SPST momentary contact pushbutton switch-Radio Shack # 275-1547 or equal
*T1-T2	International Rectifier HEXFET transistors-Digikey # IRLZ14-ND or equal
*VR1-VR3	78L05 5 VDC 100 ma. Voltage Regulator-Digikey # 78L05ACZ-ND or equal
*Voice Recognition module	VD364 Voice Recognition module-Sensory # VD364
misc.	small enclosure w/8 ohm speaker, 0.1 " male headers, hookup wire, etc.

*The following items are available directly from Shepard Engineering Concepts. A kit of programmed IC1, CR1, T1, T2, and VR1-VR3 are available for \$25.00 ppd. A kit including these items and the voice recognition module are available for \$75.00 ppd. These prices are for the continental U.S. only. **Please make payment to: Dennis Shepard.** Payment methods preferred are money orders, certified checks, and Western Union.

Three different kits are available from Shepard Engineering Concepts. The first kit consists of the preprogrammed PIC, ceramic resonator, 3 ea. 78L05 voltage regulators, and 2 ea. IRLZ HEXFET transistors for \$25.00 delivered anywhere in the continental U.S. The second kit includes the VoiceDirect 364 module ONLY for \$50.00. The third kit contains the VoiceDirect 364 Module and all components included above for \$75.00. All kits include shipping & handling anywhere in the continental U.S. California residents please add 7.50 % state sales tax.

Please make payments payable to: Dennis Shepard.

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