Glolab

Wireless Motion Detector Transmitter

*Introduction*_____

Motion detectors are used mostly to turn lights on when they sense movement of people or vehicles. The detector device is often built into an outdoor flood or porch light to illuminate a driveway or porch at night making it easier to enter your house without having to leave the light on while you are away. They also add security by turning the outside light on at night when motion is detected even while you are at home.

Detectors are available that are intended for use with security systems to sound an alarm or summon police when motion is detected even during daytime but these are usually expensive and must be wired to the alarm control box. If security is your main concern, this may be a good choice.

However, it is often convenient just to know when a person is approaching your front or back door or when a vehicle enters your driveway even in daytime. If several detectors are used, you can also identify where the motion is taking place.

The Wireless Motion Detector system described here is designed to detect motion over a narrow field of less than ten degrees so that the area is easily identified. The motion transmitter includes a motion detector, amplifier, encoder, transmitter and a battery operated power supply. It can be located indoors or outdoors. When outdoors, it can be attached to the wall of a house, to a tree or to a post using a Velcro fastener but should be protected from the weather with some type of housing such as by placing it in an unoccupied birdhouse.

*How it works*_____

Transmitter

Figure 1 is a schematic of the transmitter. PIR is a NiCERA RE200B dual element pyroelectric infrared sensor with a built-in FET amplifier. It also has an optical filter that passes infrared in the 5 to 14μm range which is most sensitive to human body radiation. As an object that emits infrared passes in front of the PIR, its output goes either more positive or more negative. Since the output signal is very small, it passes through two stages of amplification having a total maximum gain of about 10,000. Range is controlled by potentiometer R5 which adjusts the gain from 1000 to 10,000.

R1 and C1 filter any noise from the power that feeds the PIR and R2 is a load for the FET within the PIR. IC1 is either a Maxim MAX407 or Linear Technologies LT1495 dual micropower operational amplifier. R3, R4 and C2 set the IC1A amplifier gain and reference voltage and C3 limits its bandwidth to about 10Hz. C4 couples the output of IC1A into IC1B. R5, R6, R7 and R10 set the gain of IC1B and C5 limits its bandwidth to about 10Hz. R7 and R9 set its bias to 2.5 volts.

IC2 is either a Maxim MAX922 or a Linear Technologies LTC1440 dual micropower comparator. IC2A functions as a window comparator and also functions together with IC2B as a single shot. When no motion occurs and there is no output from the PIR, the output of IC1B at pin 7 rests at 2.5 volts. Resistive divider R11, R12 and R13 apply a bias input through R14 and R15 to pin 5 and pin 6 of IC2A. The level at pin 5 is 250MV more positive than at pin 6, forcing output pin 8 to a down level.

When motion is detected that produces a positive transition at IC1B pin 1, then pin 6 of IC2A is forced up through D2 and becomes more positive than pin 5. This causes output pin 8 to go up. If the motion produces a negative transition at IC1B pin 1 then IC2A pin 5 is forced down through D1 which also causes IC2A output pin 8 to go up.

The positive transition at IC2A pin 8 couples through C6 into IC2B, turning it on and causing its output pin 1 to go down. This down level pulls IC2A pin 5 down through D3 and latches it down until C6 discharges through R17 and, or R18. Program jumper PJ places a lower value R17 in parallel with R18 to reduce the time constant during

testing, When C6 discharges below the reference voltage at pin 3, IC2B turns off and pin 1 goes up again. The C6, R15, R18 time constant is about 90 seconds without PJ and 1 second with PJ. R19, R20 and R21 produce hysteresis to avoid jitter in the IC2B output during the slow discharge of C6 and they also set its reference. C7 R16 and D4 couple a narrow negative pulse into Holtek HT680 encoder IC3 to initiate a transmit sequence.

Upon being triggered by IC2B, the encoder generates three groups of bits containing data and address information and serially sends them to transmit module TM1V. The encoder can be programmed by 4 position DIP switch SA positions 1, 2 ,3 and 4 for 16 different addresses so that more than one set of transmitters and receivers can be used in close proximity without interference. Its data inputs can also be programmed by positions 5, 6, 7 and 8 to identify the transmitter as number 1, 2, 3 or 4. Only one of these switches should be ON.

The circuits are powered with 5 volts through reverse polarity protection diode D5 and Telcom TC55RP5002EZB low dropout micropower regulator IC4 by a 9 volt battery. Because of the micropower circuits used in this transmitter, standby current is only 20 microamperes which is about 100 times less than that of other motion detectors.

Construction

PC Board

The PC board is designed to fit in a Serpac model 211 enclosure available from Digi-Key and Allied. Cut a 1.2 inch round hole in the enclosure cover and attach a Fresnel lens inside with its grooves facing in. Hold it in place with pieces of scotch tape along the edges. Place an O ring under the PIR to space it off the board and solder it in place. This spacing ensures proper focal distance between the Fresnel lens in the enclosure cover and the PIR. Sockets are used for all of the DIP ICs. To assemble the board mount all of the small components first, then add the sockets. After all components are mounted feed the leads from a 9 volt battery connector through a hole in the battery compartment of the enclosure and solder them to the transmitter board holes marked plus V and minus V.

The antenna can be a stiff piece of wire 6.7 inches long. Feed it through a hole in the enclosure and attach it to the terminal block.

Testing

Connect a 9 volt battery to the transmitter. Set transmitter switch SA positions 1, 2, 3 and 4 OFF and position 5 on to identify it as detector 1. You are now ready to detect motion and transmit data to a receiver. Repeat the above for any additional detectors, using SA positions 6, 7 or 8 to identify each transmitter.

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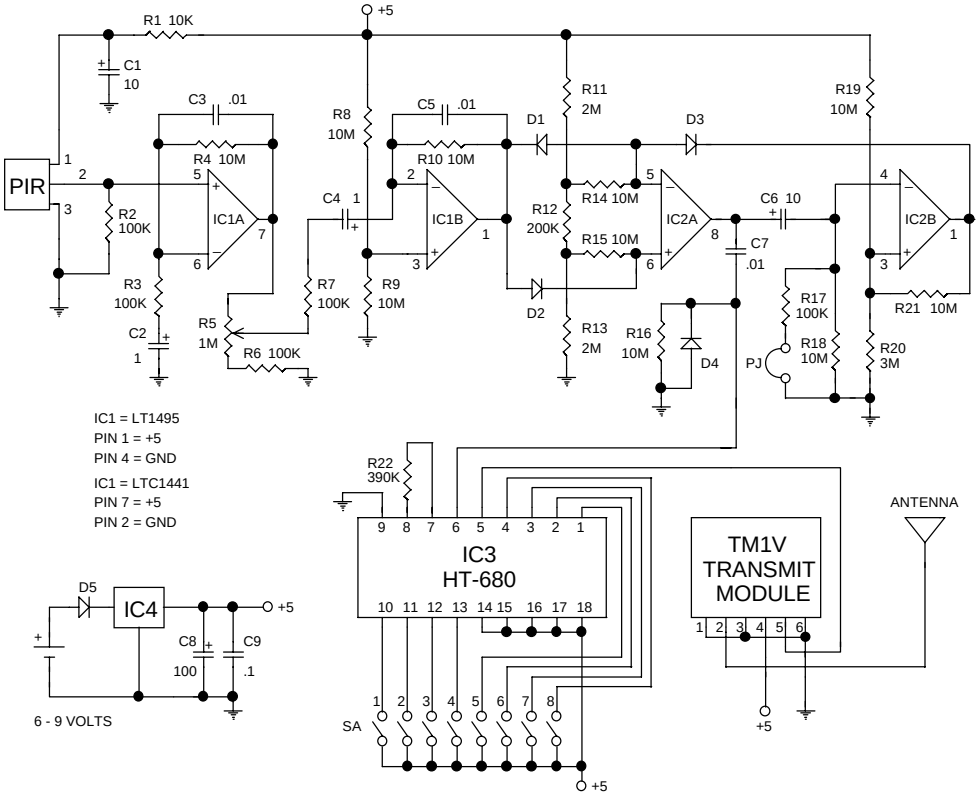

WIRELESS MOTION DETECTOR TRANSMITTER FIGURE 2

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Wireless Motion Detector Transmitter

Parts List

Wireless Motion Detector Transmitter parts
R1 - 10K 1/8 watt 5%
R2, R3, R6, R7, R17 - 100K 1/8 watt 5%
R4, R8, R9, R10, R14 R15 - 10 MEG 1/8 watt 5%
R16, R18, R19, R21 - 10 MEG 1/8 watt 5%
R20 - 3 MEG 1/8 watt 5%
R5 - 1 MEG potentiometer
R11, R13 - 2 MEG 1/8 watt 5%
R12 - 200K 1/8 watt 5%
R22 - 390K 1/8 watt 5%
C1 - 10 MFD 16 volt low leakage electrolytic
C2, C4 - 1 MFD 16 volt tantalum
C3, C5, C7 - .01 MFD 50 metalized film
C6 - 10 MFD 6.3 volt tantalum
C8 -100 MFD 10 low leakage electrolytic
C9 - .1 MFD 50 volt metalized film
D1, D2, D3, D4, D5 - 1N914B diode
SA - 8 position DIP switch
IC sockets - two 8 pin
IC socket 18 pin
O-ring spacer
PIR - RE200B pyroelectric infrared sensor
IC1 - Linear LT1495 micropower op amp
IC2 - Linear LTC1441 micropower comparator
IC3 - Holtek HT680 encoder
IC4 - Telcom TC55RP5002EZB 5 volt regulator
Glolab TM1V Transmit module
9 volt battery connector
1 position antenna terminal block
6.7 inch antenna wire
Transmit circuit board
Infrared Fresnel lens FL65 - .65” focal length
Enclosure - Serpac 211

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