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ENERGY MANAGEMENT AND PRESENCE DETECTION SMART HOMES UTILIZING GSM ENABLED SMART PHONE

Mrs. M. Divya,
M.E., E.C.E (Communication System),
Idhaya Engineering College for Women,
Chinnasalem.
divyavenkat194@gmail.com

Sr. J. Cathrina Mary,
Assistant Proffesor,
Idhaya Engineering College for Women,
Chinnasalem
sweetcathe5@gmail.com

Abstract

Recently, many researches and industries are developing smart home applications. In a smart home , electric devices (e.g., plugs, lights, TV and so on)can have the capability of wireless communications. Users are allowed to control these devices by smart phones through wireless links. However, we observe that the current control schemes are not user friendly. More specifically, users need to switch between APPs to control different kinds of controllable devices or need to transverse a long device list to find the target one. In these paper, we propose schemes to achieve the control fashion that when a user raises her smart phone to point to a devices, the phone's screen automatically pops out on the control panel of the device, and then the user can enter control commands directly. In this paper, we evaluate the proposed schemes by simulations and real implementation and the results demonstrate the effectiveness of our design.

Index Terms- Remote controller, pervasive computing, smart home environment, wireless communication.

I.INTRODUCTION

Present industry is increasingly shifting towards automation. Two principle components of today's industrial automations are programmable controllers and robots. In order to aid the tedious work and to serve the mankind, today there is a general tendency to develop an intelligent operation.PIC Microcontroller is the heart of the device which handles all the sub devices connected across it. We have used as microcontroller. It has flash type reprogrammable memory. It has some peripheral devices to play this project perform. It also provides sufficient power to inbuilt peripheral devices. We need not give individually to all devices. The peripheral devices also activates as low power operation mode. The microcontroller that has been used for this project is from PIC series. PIC microcontroller is the first RISC based microcontroller fabricated in CMOS (complementary metal oxide semiconductor) that uses separate bus for instruction and data allowing simultaneous access of program and data memory. The main advantage of CMOS and RISC combination is low power consumption resulting in a very small chip size with a small pin count. The main advantage of CMOS is that it has immunity to noise than other fabrication techniques.

SOFTWARE DESCRIPTION

MPLAB IDE is an integrated development environment that provides development engineers with the flexibility to develop and debug firmware for various Microchip devices MPLAB IDE is a Windows-based Integrated Development Environment for the Microchip Technology Incorporated PIC microcontroller (MCU) and ds PIC digital signal controller (DSC) families. In the MPLAB IDE, you can:

•Create source code using the built-in editor.
•Assemble, compile and link source code using various language tools. An assembler, linker and librarian come with MPLAB IDE. C compilers are available from Microchip and other third party vendors.
•Debug the executable logic by watching program flow with a simulator, such as MPLAB SIM, or in real time with an emulator, such as MPLAB ICE. Third party emulators that work with MPLAB IDE are also available.
•Make timing measurements.
•View variables in Watch windows.
•Program firmware into devices with programmers such as PICSTART Plus or PRO MATE II.
•Find quick answers to questions from the MPLAB IDE on-line Help.

MPLAB SIM is a discrete-event simulator for the PIC microcontroller (MCU) families. It is integrated into MPLAB IDE integrated development environment. The MPLAB SIM debugging tool is designed to model operation of Microchip Technology's PIC microcontrollers to assist users in debugging software for these devices. The PRO MATE II is a Microchip microcontroller device programmer. Through interchangeable programming socket modules, PRO MATE II enables you to quickly and easily program the entire line of Microchip PIC micro microcontroller devices and many of the Microchip memory parts.PRO MATE II may be used with MPLAB IDE running under supported Windows OS's (see Read me for PRO MATE II.txt for support list), with the command-line controller PROCMD or as a stand-alone programmer. A program written in the high level language called C; which will be converted into PIC micro MCU machine code by a compiler. Machine code is suitable for use by a PIC micro MCU or Microchip development system product like MPLAB IDE. The PIC start plus development system from microchip technology provides the product development engineer with a highly flexible low cost microcontroller design tool set for all microchip PIC micro devices. The pic start plus development system includes PIC start plus development programmer and MPLAB IDE.

The PIC start plus programmer gives the product developer ability to program user software in to any of the supported microcontrollers. The PIC start plus software running under MPLAB provides for full interactive control over the programmer.

DESCRIPTION

Microcontroller is a general purpose device, which integrates a number of the components of a microprocessor system on to single chip. It has inbuilt CPU, memory and peripherals to make it as a mini computer. A microcontroller combines on to the same microchip:

- The CPU core
- Memory(both ROM and RAM)
- Some parallel digital i/o

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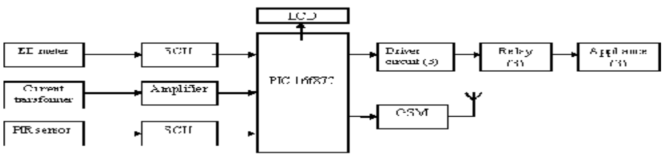
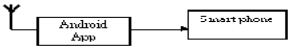


Smart phone



Various microcontrollers offer different kinds of memories. EEPROM, EPROM, FLASH etc. are some of the memories of which FLASH is the most recently developed. Technology that is used in pic16F877 is flash technology, so that data is retained even when the power is switched off. Easy Programming and Erasing are other features of PIC 16F877.

The PIC start plus development system from microchip technology provides the product development engineer with a highly flexible low cost microcontroller design tool set for all microchip PIC micro devices. The picstart plus development system includes PIC start plus development programmer and mplab ide. The PIC start plus programmer gives the product developer ability to program user software in to any of the supported microcontrollers. The PIC start plus software running under mplab provides for full interactive control over the programmer.

PIR SENSOR: (HUMAN SENSOR)

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. They are often referred to as PIR, "Passive Infrared", "Pyroelectric", or "IR motion" sensors.

PIRs are basically made of a pyroelectric sensor (which you can see above as the round metal can with a rectangular crystal in the center), which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves.

The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low. Along with the pyroelectic sensor is a bunch of supporting circuitry, resistors and capacitors. It seems that most small hobbyist sensors use the BISS0001 ("Micro Power PIR Motion Detector IC"), undoubtedly a very inexpensive chip. This chip takes the output of the sensor and does some minor processing on it to emit a digital output pulse from the analog sensor. For many basic projects or products that need to detect when a person has left or entered the area, or has approached, PIR sensors are great. They are low power and low cost, pretty rugged, have a wide lens range, and are easy to interface with. Note that PIRs won't tell you how many people are around or how close they are to the sensor, the lens is often fixed to a certain sweep and distance (although it can be hacked somewhere) and they are also sometimes set off by house pets. Some basic stats these stats are for the PIR sensor in the Adafruit shop which is very much like the Parallax one. Nearly all PIRs will have slightly different specifications, although they all pretty much work the same. If there's a datasheet, you'll want to refer to it

•Size: Rectangular
•Price: $10.00 at the Adafruit shop
•Output: Digital pulse high (3V) when triggered (motion detected) digital low when idle (no motion detected). Pulse lengths are determined by resistors and capacitors on the PCB and differ from sensor to sensor.
•Sensitivity range: up to 20 feet (6 meters) 110° x 70° detection range
•Power supply:3.3V - 5V input voltage,
•BIS0001 Datasheet (the decoder chip used)
•RE200B datasheet (most likely the PIR sensing element used)
•NL11NH datasheet (equivalent lens used)
•Parallax Datasheet on their version of the sensor

PIR sensors are more complicated than many of the other sensors explained in these tutorials (like photocells, FSRs and tilt switches) because there are multiple variables that affect the sensors input and output. To begin explaining how a basic sensor works, we'll use this rather nice diagram (if anyone knows where it originates plz let me know).

The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or

walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected. Left image from Murata datasheet. The IR sensor itself is housed in a hermetically sealed metal can to improve noise/temperature/humidity immunity. There is a window made of IR-transmissive material (typically coated silicon since that is very easy to come by) that protects the sensing element. Behind the window are the two balanced sensors.
Image from RE200B datasheet. You can see above the diagram showing the element window, the two pieces of sensing material.

Image from RE200B datasheet Once you have your PIR wired up its a good idea to do a simple test to verify that it works the way you expect. This test is also good for range testing. Simply connect 3-4 alkaline batteries (make sure you have more than 3.5VDC out but less than 6V by checking with your multi-meter!) and connect ground to the - pin on your PIR. Power goes to the + pin. Then connect a basic red LED (red LEDs have lower forward voltages than green or blue so they work better with only the 3.3v output) and a 220Ω resistor (any value from 100Ω to 1.0KΩ will do fine) to the out pin as shown. Of course, the LED and resistor can swap locations as long as the LED is oriented connection and connects between out and ground. Once you have the breadboard wired up, insert batteries and wait 30-60 seconds for the PIR to 'stabilize'. During that time the LED may blink a little. Wait until the LED is off and then move around in front of it, waving a hand, etc, to see the LED light up! Retriggering once you have the LED blinking, look on the back of the PIR sensor and make sure that the jumper is placed in the L position as shown above. Now set up the testing board again. You may notice that when connecting up the PIR sensor as above, the LED does not stay on when moving in front of it but actually turns on and off every second or so. That is called "non-retriggering". Now change the jumper so that it is in the H position. If you set up the test, you will notice that now the LED does stay on the entire time that something is moving. That is called "retriggering".(The graphs above are from the BISS0001 datasheet, they kind of suck).For most applications, "retriggering" (jumper in H position) mode is a little nicer. If you need to connect the sensor to something edge-triggered, you'll want to set it to "non-retriggering" (jumper in L position). Changing pulse time and timeout length. There are two 'time-outs' associated with the PIR sensor. One is the "Tx" timeout: how long the LED is lit after it detects movement. The second is the "Ti" timeout which is how long the LED is guaranteed to be off when there is no movement. These are not easily changed but if you're handy with a soldering iron it is within reason. First, let's take a look at the BISS datasheet again. Determining R10 and R9 isn't too tough. Unfortunately this PIR sensor is mislabeled (it looks like they swapped R9 R17). You can trace the pins by looking at the BISS001 datasheet and figuring out what pins they are - R10 connects to pin 3 and R9 connects to pin 7. The capacitors are a little tougher to determine, but you can 'reverse engineer' them from timing the sensor.

1 POWER SUPPLY:

Block diagram

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation. A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.
Block diagram (Power supply)
Working principle
Transformer
The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp.

The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

Bridge rectifier

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners. Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward bias D3 and reverse bias D4. The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow.
The path for current flow is from point B through D1, up through RL, through D3, through the secondary of the transformer back to point B. this path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3. One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through RL, through D2, through the secondary of T1, and back to point A. This path is indicated by the broken arrows. Waveforms (3) and (4) can be observed across D2 and D4. The current flow through RL is always in the same direction. In flowing through RL this current develops a voltage corresponding to that shown waveform (5). Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier. One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit.
This may be shown by assigning values to some of the components shown in views A and B. assume that the same transformer is used in both circuits. The peak voltage developed between points X and y is 1000 volts in both circuits. In the conventional full-wave circuit shown—in view A, the peak voltage from the center tap to either X or Y is 500 volts. Since only one diode can conduct at any instant, the

maximum voltage that can be rectified at any instant is 500 volts. The maximum voltage that appears across the load resistor is nearly-but never exceeds-500 v0lts, as result of the small voltage drop across the diode. In the bridge rectifier shown in view B, the maximum voltage that can be rectified is the full secondary voltage, which is 1000 volts. Therefore, the peak output voltage across the load resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit.

IC voltage regulators

Voltage regulators comprise a class of widely used ICs. Regulator IC units contain the circuitry for reference source, comparator amplifier, control device, and overload protection all in a single IC. IC units provide regulation of either a fixed positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be selected for operation with load currents from hundreds of milli amperes to tens of amperes, corresponding to power ratings from milli watts to tens of watts.

Circuit diagram (Power supply

A fixed three-terminal voltage regulator has an unregulated dc input voltage, Vi, applied to one input terminal, a regulated dc output voltage, Vo, from a second terminal, with the third terminal connected to ground. The series 78 regulators provide fixed positive regulated voltages from 5 to 24 volts. Similarly, the series 79 regulators provide fixed negative regulated voltages from 5 to 24 volts.

•For ICs, microcontroller, LCD - 5 volts PIR-based motion detector:

In a PIR-based motion detector, the PIR sensor is typically mounted on a printed circuit board which also contains the necessary electronics required to interpret the signals from the chip. The complete circuit is contained in a housing which is then mounted in a location where the sensor can view the area to be monitored. Infrared energy is able to reach the sensor through the window because the plastic used is transparent to infrared radiation (but only translucent to visible light). This plastic sheet prevents the introduction of dust and insects which could obscure the sensor's field of view. A few mechanisms have been used to focus the distant infrared energy onto the sensor surface. The window may have Fresnel lenses mounded into it. Alternatively, sometimes PIR sensors are used with plastic segmented parabolic mirrors to focus the infrared energy; when mirrors are used, the plastic window cover has no Fresnel lenses molded into it. A filtering window (or lens) may be used to limit the wavelengths to 8-14 micrometers which is most sensitive to human infrared radiation (9.4 micrometers being the strongest). The PIR device can be thought of as a kind of infrared 'camera' which remembers the amount of infrared energy focused on its surface. Once power is applied to the PIR the electronics in the PIR shortly settle into a quiescent state and energize a small relay. This relay controls a set of electrical contacts which are usually connected to the detection input of an alarm control panel. If the amount of infrared energy focused on the sensor changes within a configured time period, the device will switch the state of the alarm output relay. The alarm output relay is typically a "normally closed (NC)" relay, also known as a "Form B" relay. A person entering the monitored area is detected when the infrared energy emitted from the intruder's body is focused by a Fresnel lens or a mirror segment and overlaps a section on the chip which had previously been looking at some much cooler part of the protected area. That portion of the chip is now much warmer than when the intruder wasn't there. As the intruder moves, so does the hot spot on the surface of the chip. This moving hot spot causes the electronics connected to the chip to de-energize the relay, operating its contacts, thereby activating the detection input on the alarm control panel. Conversely, if an intruder were to try to defeat a PIR perhaps by holding some sort of thermal shield between himself and the PIR, a corresponding 'cold' spot moving across the face of the chip will also cause the relay to de-energize unless the thermal shield has the same temperature as the objects behind it. Manufacturers recommend careful placement of their products to prevent false alarms. They suggest mounting the PIRs in such a way that the PIR cannot 'see' out of a window. Although the wavelength of infrared radiation to which the chips are sensitive does not penetrate glass very well, a strong infrared source (a vehicle headlight, sunlight reflecting from a vehicle window) can overload the chip with enough infrared energy to fool the electronics and cause a false (non-intruder caused) alarm. A person moving on the other side of the glass however would not be 'seen' by the PIR. They also recommended that the PIR not be placed in such a position that an HVAC vent would blow hot or cold air onto the surface of the plastic which covers the housing's window. Although air has very low emissivity (emits very small amounts of infrared energy), the air blowing on the plastic window cover could change the plastic's temperature enough to, once again, fool the electronics.

PIRs come in many configurations for a wide variety of applications. The most common used in home security systems has numerous Fresnel lenses or mirror segments and has an effective range of about thirty feet. Some larger PIRs are made with single segment mirrors and can sense changes in infrared energy over one hundred feet away from the PIR. There are also PIRs designed with reversible orientation mirrors which allow either broad coverage (110° wide) or

•For alarm circuit, op-amp, relay circuits - 12 volts

Passive Infrared Sensors (PIR):

Passive Infrared sensors (PIR sensors) are electronic devices which measure infrared light radiating from objects in the field of view. PIRs are often used in the construction of PIR-based motion detectors, see below. Apparent motion is detected when an infrared emitting source with one temperature, such as a human body, passes in front of a source with another temperature, such as a wall. All objects emit infrared radiation; see black body radiation. This radiation (energy) is invisible to the human eye but can be detected by electronic devices designed for such a purpose. The term 'passive' in this instance means the PIR does not emit any energy of any type but merely sits 'passive' accepting infrared energy through the front of the sensor, known as the sensor face. At the core of a PIR is a solid state sensor or set of sensors, with approximately 1/4 inch square area. The sensor areas are made from a pyroelectric material. The actual sensor on the chip is made from natural or artificial pyroelectric materials, usually in the form of a thin film, out of gallium nitride (GaN), cesium nitrate ($CsNO_3$), polyvinyl fluorides, derivatives of phenylpyrazine, and cobalt phthalocyanine. (See pyroelectric crystals.) Lithium tantalite ($LiTaO_3$) is a crystal exhibiting both piezoelectric and pyroelectric properties. The sensor is often manufactured as part of an integrated circuit and may be comprised of one (1), two (2) or four (4) 'pixels' comprised of equal areas of the pyroelectric material. Pairs of the sensor pixels may be wired as opposite inputs to a differential amplifier. In such a configuration, the PIR measurements cancel each other so that the average temperature of the field of view is removed from the electrical signal; an increase of IR energy across the entire sensor is self-cancelling and will not trigger the device. This allows the device to resist false indications of change in the event of being exposed to flashes of light or field-wide illumination. (Continuous bright light could still saturate the sensor materials and render the sensor unable to register further information.) At the same time, this differential arrangement minimizes common-mode interference; this allows the device to resist triggering due to nearby electric fields. However, a differential pair of sensors cannot measure temperature in that configuration and therefore this configuration is specialized for motion detectors, see below. Direction sensing motion detector. This motion detector circuit will both detect motion and indicate the direction that an infrared emitting body is moving. The IC2 is a CD4538 dual single shot. The first single shot to receive a trigger input from IC1C or IC1D will turn its output on to indicate the direction of detection and will also inhabit the other single shot so that it cannot be triggered while the first single shot is on. This type of motion detector can be used to indicate people entering or leaving a building or in some robotic applications.

Results

Once you have your PIR wired up its a good idea to do a simple test to verify that it works the way you expect.

This test is also good for range testing. Simply connect 3-4 alkaline batteries (make sure you have more than 3.5VDC out but less than 6V by checking with your multi-meter) and connect ground to the - pin on your PIR. Power goes to the + pin. Then connect a basic red LED (red LEDs have lower forward voltages than green or blue so they work better with only the 3.3v output) and a 220Ω resistor (any value from 100Ω to 1.0KΩ will do fine) to the out pin. Of course, the LED and resistor can swap locations as long as the LED is oriented connection and connects between out and ground. Now when the PIR detects motion, the output pin will go "high" to 3.3V and light up the LED. Once you have the breadboard wired up, insert batteries and wait 30-60 seconds for the PIR to 'stabilize'. During that time the LED may blink a little. Wait until the LED is off and then move around in front of it, waving a hand, etc, to see the LED light up. Once you have the LED blinking, look on the back of the PIR sensor and make sure that the jumper is placed in the L position as shown above. Now set up the testing board again. You may notice that when connecting up the PIR sensor as above, the LED does not stay on when moving in front of it but actually turns on and off every second or so. That is called "non-retriggering". Now change the jumper so that it is in the H position. If you set up the test, you will notice that now the LED does stay on the entire time that something is moving. That is called "retriggering". For most applications, "retriggering" (jumper in H position) mode is a little nicer. If you need to connect the sensor to something edge-triggered, you'll want to set it to "non-retriggering" (jumper in L position). Changing pulse time and time out length. There are two 'timeouts' associated with the PIR sensor. One is the "Tx" timeout: how long the LED is lit after it detects movement. The second is the "Ti" timeout which is how long the LED is guaranteed to be off when there is no movement. These are not easily changed but if you're handy with a soldering iron it is within reason. It also detects human detector. When any persons enters into the particular distance in home, the device notifies us human detection as ON. If no one is there it displays as human not detected. Additionally all this information's are sending to the smart phone where it is connected to GSM, every values are shown in phone by using of android application.

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