

# A Human Detection Method for Automatic Control of Power Consumption by Using Zigbee RSSI Changes

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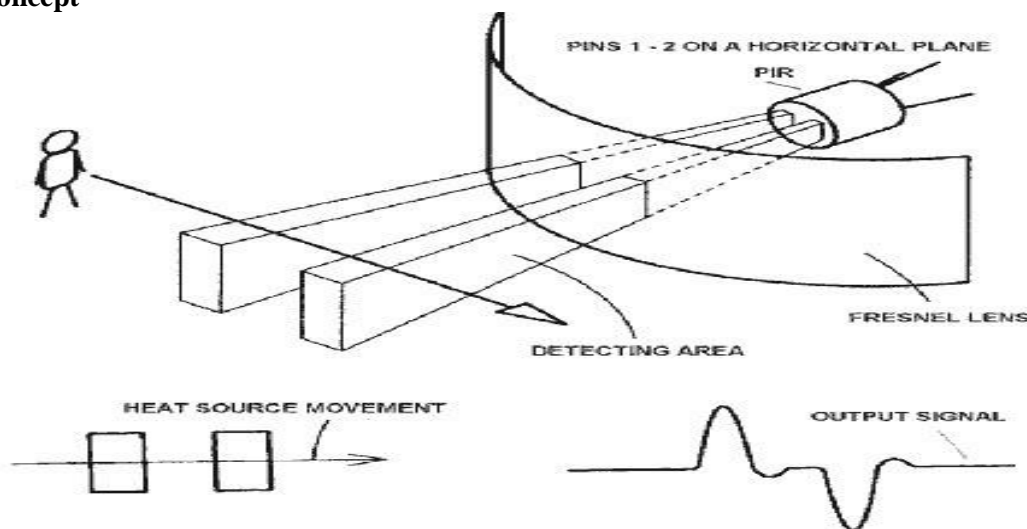
## Abstract

The paper presents a novel method for human detection that is applied to the automatic control of home appliances' power consumption. The method uses a wireless smart outlets network and changes of received signal strength indicator (RSSI) or Passive Infrared Sensor(PIR) between stationary communication nodes (2.4 GHz smart outlets). The main idea is to monitor the changes of PIR/RSSI which violate the established radio communication field between nodes inside a room, due to a human's presence. When a person enters into the established radio communication field, he/she induces the change of RSSI/PIR which is periodically read during the message exchange between wireless nodes. Based on the detected changes with regard to the initial thresholds, the system detects human presence and responds with the automatic control of power consumption of all appliances connected to the power network. Such an approach increases users' awareness by contributing to the energy savings and low installation costs.

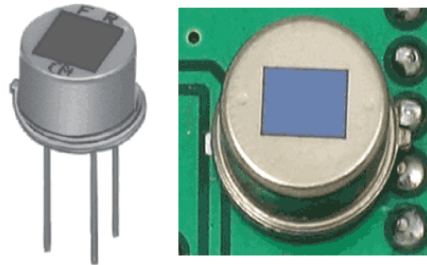
## 1. Introduction

Rapid technology development has brought a wide variety of available electronic appliances, but the requisite energy sources exploitation has become a serious problem. In order to decrease the energy wasting and to increase the energy awareness, several ideas have been proposed. Most of the energy saving solutions are based on smart outlets utilization [1], [2]. Using the smart outlets, consumers are able to monitor the power consumption of each plugged device and to enable a simple set of commands: on/off switching, displaying the status and network discovery. It is possible to display the consumption of each appliance as well as a group of appliances in real time or displaying the consumption in time on a daily, weekly, monthly basis in conjunction with the costs. By using the smart outlets, users are able to have better insight into the power consumption of their households. The most of the available energy feedback solutions provide a very technical view on the consumption. Even the consumers have the insight into the consumption data; in many cases they take no corrective actions to improve the efficiency. A fast and busy way of living makes users oblivious to perform simple actions that would conserve the energy, so there needs to be an automatic solution for the energy consumption management. In our previous paper [3] we presented such an intelligent home system. It improves the energy efficiency by connecting smart outlets, smart light switches and a number of residential human detection sensors together to an ecosystem for smart home.

## 2. Basic Concept



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.



### 3. Evaluation Results

In this research we have shown that the proposed method for human detection is more reliable and robust than using PIR technology. In Table I we present the comparison of these two approaches. PIR sensor is cheap and widely used solution which is mainly dependant on its lens quality and ambient temperature. As the temperature is higher, the difference to human body temperature is decreasing as well as the detection accuracy, which is not the case with radio signal's RSSI. Also when there is no movement for a period of time, the PIR sensor is unable to detect presence, which is not the case with our method (100% accuracy). Proposed technology does not include additional costs or installation efforts because it is based upon existing wireless infrastructure (Zigbee outlets).

TABLE I  
PIR AND RSSI PRESENCE DETECTION TECHNOLOGY COMPARISON

Sensor type	Useful Informator grade	Movement detectable	Human detection	Human detection	Human detection	Price	Installation complexity
PIR	Low	Yes	No	No	Poss.	Low	Med
RSSI	Med	Yes	Yes	Yes	Poss.	Low	Low

A PIR-based motion detector is used to sense movement of people, animals, or other objects. They are commonly used in burglar alarms and automatically-activated lighting systems. They are commonly called simply "PIR," or sometimes "PID," for 'passive infrared detector'.

### 4. Operation

Strictly speaking, individual PIR sensors do not detect motion; rather, they detect abrupt changes in temperature at a given point. As an object, such as a human, passes in front of the background, such as a wall, the temperature at that point will rise from room temperature to body temperature, and then back again. This quick change triggers the detection. Moving objects of identical temperature will not trigger a detection.<sup>[1][2][3][4][5][6][7]</sup> PIDs can be equipped with more than one internal sensing element so that, with the appropriate electronics, it can detect the apparent direction of movement. As an object passes in front of adjacent sensors in turn, this implies the direction of movement. This may be used by on-board electronics to reduce false alarms, i.e., by requiring adjacent sensors to trip in succession. It may also be used to signal the direction of movement to a monitoring apparatus. PIDs come in many configurations for a wide variety of applications. The most common models have numerous Fresnel lenses or mirror segments, an effective range of about ten metres (thirty feet), and a field of view less than 180 degrees. Models with wider fields of view, including 360 degrees, are available -- typically designed to mount on a ceiling.

## 5. Focusing

Different mechanisms can be used to focus the distant infrared energy onto the sensor surface.

### References

- [1] M. Weiss, D. Guinard, "Increasing Energy Awareness Through Webenabled Power Outlets", In Proc. Of Mum 2010 (9th Acm Inter.Conf. On Mobile And Ubiquitous Multimedia), Limassol, Cyprus, 2010
- [2] J. Han, H. Lee, K.R. Park, "Remote-Controllable And Energy-Saving Room Architecture Based On Zigbee Communication", Ieee Trans. On Consumer Electronics, Vol. 55, No. 1, Pp. 264-268, Feb 2009
- [3] B. Mrazovac, M. Z. Bjelica, I. Papp, N. Teslic, "Towards Ubiquitous Smart Outlets For Safety And Energetic Efficiency Of Home Electric Appliances", Icce 2011, Berlin, Germany 2011, Pp. 324-328.
- [4] B. Mrazovac, M. Z. Bjelica, I. Papp, N. Teslic, "Smart Audio/Video Playback Control Based On Presence Detection And User Localization In Home Environment", In Proceedings Of Ecbs-Eerc 2011, Full-Paper, Bratislava, Slovakia 2011, Pp. 44-53



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