Chapter 9

PIR–Enabled Security System for Internet of Things Using Raspberry Pi

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ABSTRACT

Internet of Things (IoT) is an evolution of mobile, home and embedded systems that can be connected to internet increasing greater capabilities of data analytics to extract meaningful information, which can further used for decision making. Billions of devices are connected to internet and soon its number may grow higher than number of human beings on this planet. These connected devices integrated together can become a network of intelligent systems that share data over the cloud to analyze. IoT is an emerging technology where several machines are embedded with low power consuming sensors that allow them to rely data from each other with little or no human intervention. Especially, PIR motion sensor plays a key role in security systems for detecting movements, intrusion and occupancy by interacting with other devices simultaneously like alarms, cameras etc. In this paper, researchers studied IoT applications using PIR motion sensor and proposed architecture and algorithms to be implemented for better development of security systems.

INTRODUCTION

IoT has been emerged with an old concept already implemented in cash machines more than 50 years ago. IoT is continuing its success journey till today with an invention of Raspberry Pi, a small credit size computer. Raspberry Pi is a series of single board size computer and can be integrated with many other devices. Raspberry Pi is well suited as an array of sensor hub used to propagate information through remote protocols or via web server. A big contribution of IoT is not about smart devices, but about sensors (Figure 1). Sensors transforms analog data collected from scanning the environment to digital data,

DOI: 10.4018/978-1-5225-2947-7.ch009
but never do any processing. Advances in sensor fusion for remote computing could also lead to new future applications. These tiny innovative sensors can be attached to everything from solid objects to human organs. They record and send data back to the cloud for analysis to make decisions. In machine learning, sensors are the key to gather information from physical objects to analyze. In recent years, the development of sensor technology, wireless network technology, signal processing technology tracking and recognizing intruders have gradually became the best area for researchers. For better security in most sensitive areas of industries, organizations and homes, the surroundings are equipping with devices embedded with various sensors which further integrated and communicated with other devices to generate some analytical data to overcome the security breaches if any.

Especially in this regard, PIR motion sensor plays a key role in security systems for detecting movements, intrusion and occupancy by interacting with other devices like alarms and cameras simultaneously.

In this area of context, researchers have tried to combine their virtues and proposed to develop a distributed system with various sensor nodes like PIR motion sensor, alarm sensor, camera sensors and facial recognition systems. The proposed distributed sensor network is developed based on the pyroelectric infrared sensor node that can identify the tracking and recognition of human objects in its small area of field. The passive or pyroelectric motion sensor has several advantages like high capability of identifying infrared radiations, low power consumption, high performance with independent of illumination, angular rate of sensitivity range, and responds properly in case of moving objects.

In this paper, researchers studied several IoT applications and identified security based applications are the most serious and sensitive area where IoT can contribute a lot. In this research, authors used a PIR motion sensor and proposed architecture for its better implementation of distributed security systems. Finally authors proposed certain algorithms to be implemented at different levels of security.

This chapter is organized as follows: First, the authors of this chapter reviewed the literature of the research articles and journals to understand clearly about working functionality of the sensors and how they can be implemented in the development of distributed security systems. Second, authors studied opportunities and application of IoT for better understanding of security areas. Third, architecture is proposed by considering PIR motion sensor as a primary device for human/intruder detection. Raspberry pi IoT device is included in the architecture as an interface for data receiving and transferring to other systems and servers for data analysis. Later, authors clearly studied new security system implementation workflow by considering two test cases for human or intruder detection. Authors developed flowcharts to represent the workflow of the system and also developed an algorithm which clearly explains how the system work proceeds. Finally, this chapter identified the limitation and challenges facing by the internet of things during its success race.