

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/286592731>

Design of Small Smart Home system based on Arduino

Conference Paper · August 2014

DOI: 10.1109/EECCIS.2014.7003731

CITATIONS

31

READS

3,378

2 authors:



Andi Adriansyah

Universitas Mercu Buana

25 PUBLICATIONS 90 CITATIONS

[SEE PROFILE](#)



Akhmad Wahyu Dani

Universitas Mercu Buana

6 PUBLICATIONS 41 CITATIONS

[SEE PROFILE](#)

Some of the authors of this publication are also working on these related projects:



Small smart community: An application of internet of things [View project](#)

Design of Small Smart Home System Based on Arduino

Andi Adriansyah

Akhmad Wahyu Dani

Department of Electrical Engineering,
Faculty of Engineering, Universitas Mercu Buana
Jl. Raya Meruya Selatan, Kembangan, Jakarta, 11650, Indonesia
andi@mercubuana.ac.id

Abstract -- Smart Home is applied in order to provide comfort, energy efficiency and better security. Smart Home System is still rarely used in Indonesia because of the cost and the difficulty of getting the device. The objective of this paper is to offer a Small Smart Home System designed and created by utilizing WLAN network based on Arduino microcontroller. The system is able to monitor and control lights, room temperature, alarms and other household appliances. Results from testing the system show proper control and control monitoring functions can be performed from a device connected to a network that supports HTML5.

Keywords -- Smart Home, Microcontroler Arduino, WLAN

I. INTRODUCTION

Smart Home is technology to make a house to become intelligent and automated. Usually, that technology has automation systems for lighting, temperature control, security and many other functions [1]. According to Robles and Kim [2], Smart Home is the term for determining residence using the control system to integrate home automation system. The system allows integrating electronic devices controller with only a few buttons that are connected with the simple telecommunications system. Smart Home includes communications, entertainment, security, convenience, and information systems [3]. There are several terms that are commensurate with the Smart Home such as: Home Automation, Intelligent Building or Home Networking.

Since it was first formally introduced by the American Association of House Builders [4], Smart Home drives a lot of research to develop performance, types of controlled equipment and telecommunications systems more reliable. Several studies in the field of Smart Home are as follows. Khyal Khan, and Shehzadi [5] focused on controlling

and provide security when the user is away from the place. The system is SMS based and uses wireless technology. Kaur [6] designed a microcontroller-based Home Automation System which focuses on security that includes password-based locking system, c

II. SYSTEM DESIGN

The system was designed by having several blocks, namely: input/output block, the microcontroller block, networking block and controlling/monitoring devices block. The whole system can be seen in Fig. 1. Detailed explanations of each block are as follows.

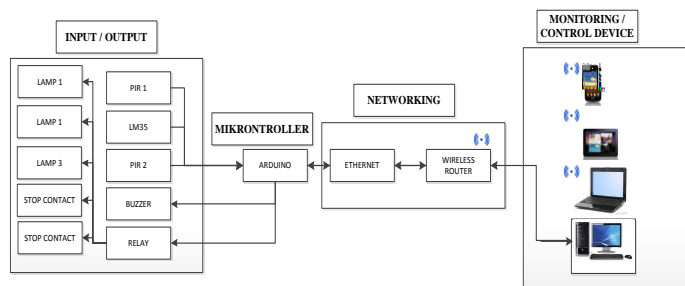


Fig. 1. Block Diagram of Proposed System

A. Input/Output Block

Input/output block consists of two pieces of PIR (Passive Infra-Red) motion sensor and an LM35 temperature sensor as inputs and some lamps, sockets, relay and buzzer as outputs.

PIR sensor is used to detect the presence of motion. The sensor readings are used to turn off the lights if there is no activity and turn on the lights otherwise. In addition, this sensor is also used for security systems to detect suspicious movements. If it detects any suspicious movement an alarm (buzzer) will sound. An LM35 is functioning as temperature monitoring. This sensor also serves as an input in order to execute some sockets. The socket will be in on condition when the temperature exceeds a certain limit. This condition will activate a fan or Air Condition (AC) while connected to the socket. Connection circuit between microcontroller system with a PIR sensor and an LM35 sensor is shown in Fig. 2 and Fig. 3.

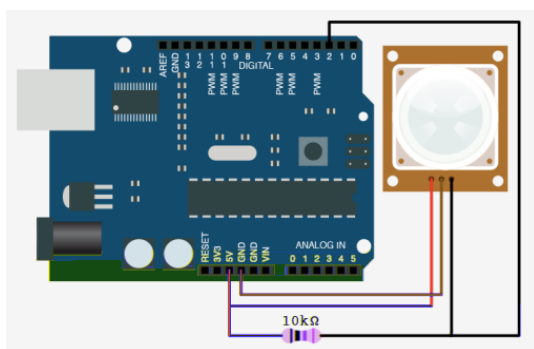


Fig. 2. Connection Circuit of PIR Sensor

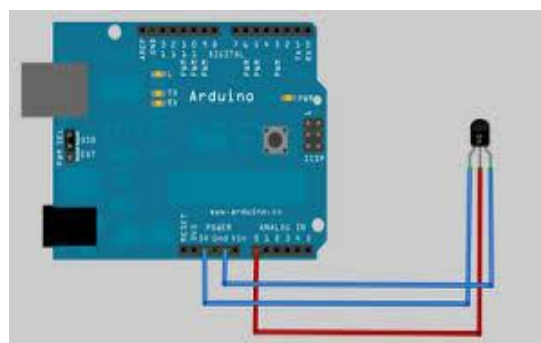


Fig. 3. Connection Circuit of LM35 Sensor

Output part consists of the relays and buzzer. Buzzer serves as a warning alarm when there is suspicious movement. Relays connected with lamps and socket. Relay circuit is shown in Fig. 4.



Fig. 4. Relay Circuit

B. System Microcontroller

The second block is a microcontroller system that serves as the center of all systems and regulates all activities of the input/output system. The system used in this paper is Arduino. Arduino is a system that uses ATmega 328 as its microcontroller. Arduino consists of an Arduino Board as hardware part and an IDE (Integrated Development Environment) that used C-like as its software language. All devices from input/output and networking block are connected to this. The Arduino system is depicted in Fig.5.

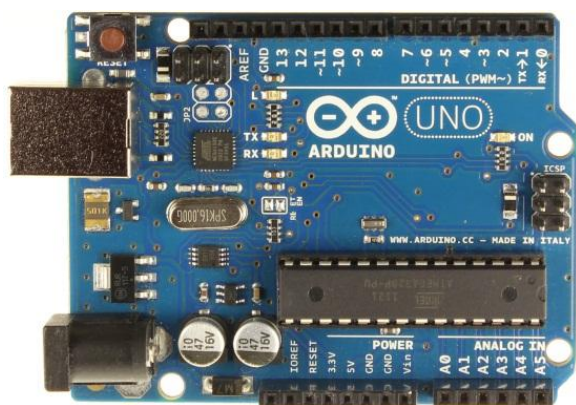


Fig. 5. Arduino System

C. Network Block

The third is network block that consists of an Ethernet part and a wireless router device. An Arduino Ethernet Shield is used to connect the Arduino board to the Internet via 3G/4G Wireless Router. Arduino Ethernet Shield is made based on the Wiznet W5100 Ethernet chip which provides the ability to network with TCP and UDP. Ethernet shield is shown in Fig. 6.

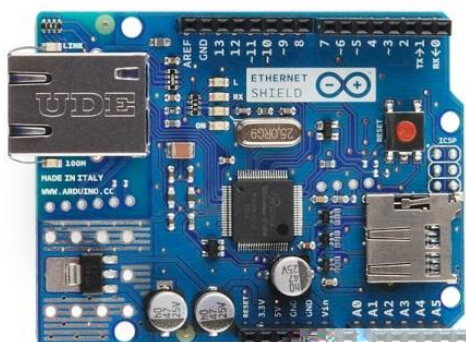


Fig. 6. Arduino Ethernet Shield

D. Monitoring/Controlling Device

The last block is monitoring/controlling that consists of any devices such as: HP, tablet, laptop or PC. These devices connected to LAN or WLAN via network block using HTML5 with two-way communication. The situation and conditions of home based on the sensor readings sent to the monitoring device every two seconds. Status of the equipment that monitored and controlled will be seen in the monitoring device. While the monitoring device able to control appliances at home at any time.

E. Smart Home Designed

Fig. 7 shows the implementation of Smart Home designed. It can be seen that the system has four lamps, two PIR sensors, an LM35 temperature sensor, two sockets and buzzer. All equipment's placed in each planned place. A scenario has been designed to control all equipment's. This scenario then was written in C-like Arduino language.

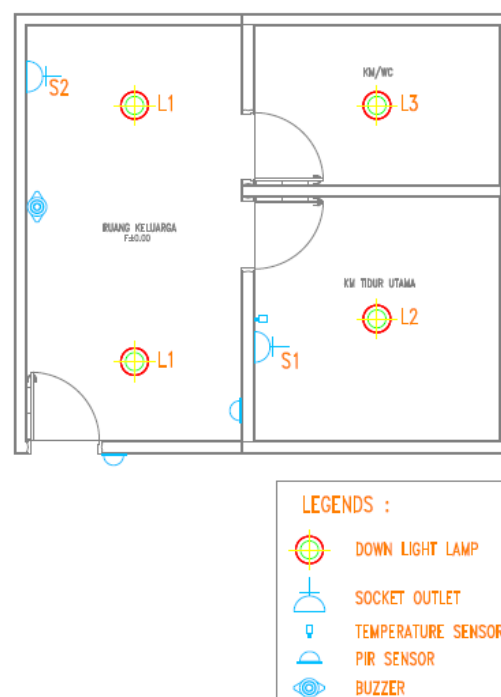


Fig. 7. Smart Home Layout Designed

III. EXPERIMENT RESULTS

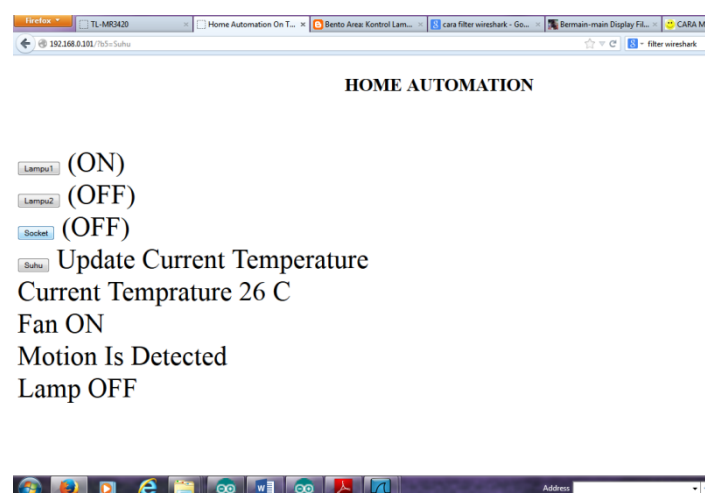
A small smart home system has been designed. All of equipment needed, Arduino microcontroller system and network devices connected as planned. Fig. 8 shows prototype small smart home system.



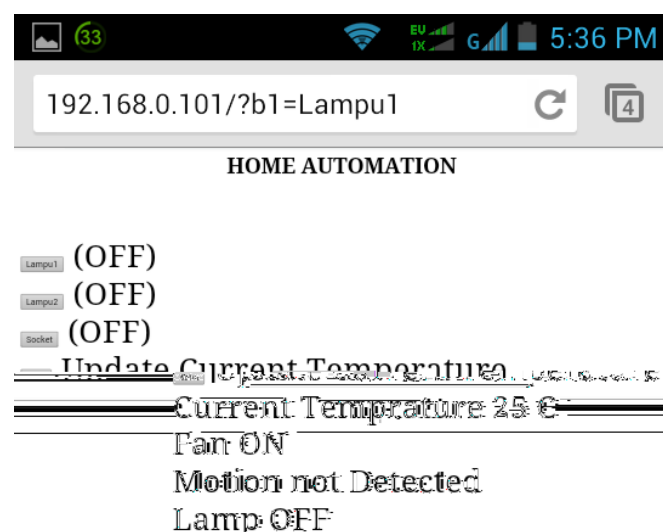
Fig. 8. Smart Home System Hardware Implementation

Web monitor display to know any status of home condition is shown in Fig. 9. Based on this figure, it can be seen there are 4 pieces button: the first and second buttons are used to control lights, the third button is used to activate the socket,

while the fourth button is used to update the temperature automatically. Below the button status, monitor shows room temperature, fan socket status, PIR status and Lamp status as well. Generally, HP web monitor display is the same as in laptop.



(a)



(b)

Fig. 9. Web Display: (a) In Laptop and (b) In HP

Some experiment has been conducted to know system reliability. Tests are performed in lab by testing all sensors, relays, sockets and buzzer. Table 1 shows the test results.

TABLE I. RESULTS OF SYSTEM TEST

No	Test	Function	Procedure	Result
1	Sensor PIR1	PIR Sensor used for Lamp activation	Lamp will on while any move detected	OK

2	Sensor PIR1	PIR Sensor used for move detection	Buzzer will on while any move detected	OK
3	Push Button1	For Lamp activation	Lamp will active depend on button	OK
4	Push Button2	For Lamp activation	Lamp will active depend on button	OK
5	Push Button3	For socket activation	Socket will active depend on button	OK
6	LM35	1. For temperature monitor	LM35 send data to Arduino microcontroller	OK
		2. For temperature regulator	Fan or AC will active while temperature is exceeds a certain limit	OK

Network analysis also has been done to know network performance using the software tool named as Wireshark. With this software, all existing packages in network can be displayed. Based on network analysis result that captured it shows that there are good communication between home equipment and monitoring device. Fig. 10 shows network analysis result that captured while first button is pressed.

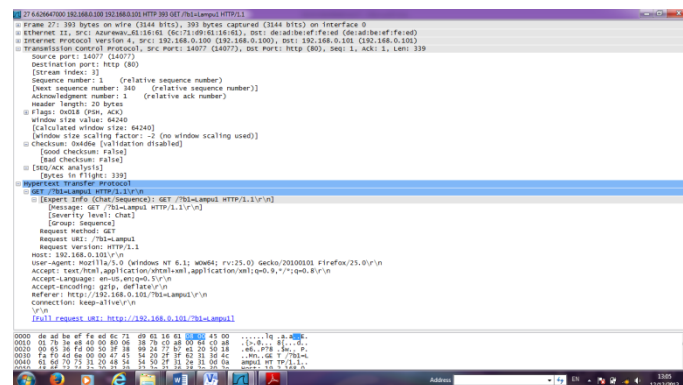


Fig. 10. Network Analysis

This paper demonstrates that the Small Smart Home System via WLAN network has been successfully designed. System is able to work properly, all equipment can be controlled via the internet with reliably and results can be displayed and controlled by multi-type devices perfectly. The performance of the communication system works well, although it is highly dependent on the internet provider.

REFERENCES

- [1] Sripan, M. Lin, X. Petchlorlean, P. Ketcham, M., "Research and Thinking of Smart Home Technology", International Conference on Systems and Electronic Engineering (ICSEE'2012), December 18-19, 2012, Phuket, Thailand
- [2] Robles, R. J., & Kim, T., "Applications, Systems and Methods in Smart Home Technology: A Review", International Journal of Advanced Science and Technology, Vol. 15, 2010.
- [3] Redriksson, V., "What is a Smart Home or Building", 2005, unpublish.
- [4] Aldrich, F., "Smart Homes: Past, Present and Future, In: Inside the Smart Home", Edited by Harper, R., Springer-Verlag, London, 2003, pp. 17-40.
- [5] Khiyal, M. S. H., Khan, A., & Shehzadi, E., "SMS Based Wireless Home Appliance Control System (HACS) for Automating Appliances and Security", Issues in Informing Science and Information Technology Volume 6, 2009.
- [6] Kaur, I., "Microcontroller Based Home Automation System with Security", International Journal of Advanced Computer Science and Applications (IJACSA), Vol. 1, No. 6, 2010.
- [7] ElShafee, A. & Hamed, K. A., "Design and Implementation of a WiFi Based Home Automation System", World Academy of Science, Engineering and Technology 68, 2012.
- [8] Jin, C., "A Smart Home Networking Simulation for Energy Saving", Master thesis, Carleton University, Canada. 2011.
- [9] Hamed, B., "Design & Implementation of Smart House Control Using LabVIEW", International Journal of Soft Computing and Engineering (IJSCE), Vol. 1, Issue 6, 2012.
- [10] Schaefer, F. M and Kays, R., "A Wireless Multi-Channel Transmission System for Smart Home Applications", Proc. Of European Wireless Conference 20014, pp. 1-6