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Study of Smart Device based on Client-Server Communication on Linux using Socket Programming in 'C'

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Abstract

Smart device is an intelligent hardware which has more smart features. When a normal hardware is implementing on IOT, then a new hardware is develop in the form of smart hardware. When smart hardware is connect to a secure operating system as linux, the hardware is more secure, then hardware is known as smart device. The mainly four components of linux as utility, shell programming, kernel and hardware for develop a structure of linux. In this work discuss the smart devices, linux OS with components, client-server model and socket programming briefly and discuss the review of literature related to this work. In this paper we implement client and server on linux using socket programming in c and then communication is success for message interchange using inter-process communication.

Keywords: IOT, Linux OS, CPU, RAM, Socket, IPC, Client-Server

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INTRODUCTION

Smart device means a device work on any platform, portable form, versatile and secure with scalable and easily work with distributed system [1]. Linux have more features as highly secure, portable, work on any hardware platform, and scalable [2]. In this study, work on linux using socket programming in 'c' for communication between client and server under smart devices.

SMART DEVICES

Smart device is an advance hardware based on IOT system [3], [4]. Many smart device like smart vehicles, smart phones, smart doorbells, smart thermostats, smart locks, smart key chain and smart bands etc related on IOT system. Arduino is a hardware used for develop a smart device based on arduino programming. Linux is applied on hardware for security and easily communication with distributed form system.

Linux OS

Linux is a distributed operating system based on unix [5]. Linux have more features like open source platform, freeware with portable, keep running, work on any hardware platform, scalable, secure and versatile nature [6]. There are four main components of linux as utilities, shell, kernel and hardware show on Figure 1 as:

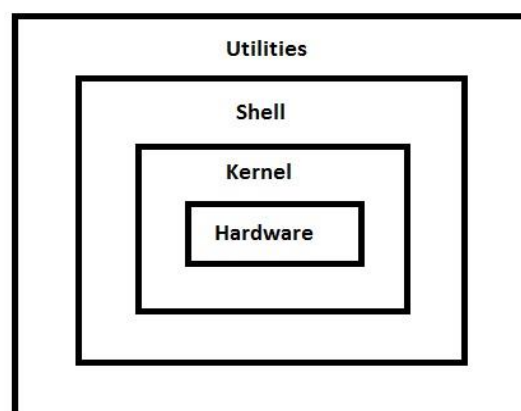


Fig. 1: System architecture of linux.

Following Table 1 show the concept with example of linux components as:

Model of Client-Server Computing

Client server model is a distributed arrangement, consist a two component, first is response or service provider called server and second is requester called client. This model is exchange the message in the form of request-response pattern by using inter-process communication and exchanges the data using cross platform [7]. Client and server communicate on separate device but reside

under equivalent arrangement. Following Figure 2 shows the structure of client server computing system as:

Socket Programming

A socket is a method on network for interchange like sent and receives the message between different network mechanisms [8]. Following Table 2 show the steps and methods for client server communication using socket programming in 'c' as:

LITERATURE REVIEW

Some important papers are used for this study in the form of review as show in Table 3 as:

Analysis

When we analysis the client and server on linux we use socket programming written in 'c'. When we write a source code for a client and server, first run a server for waiting a client, show in screenshot on Figure 3 as:

When a server is waiting for client then run a client program for connectivity to server. The output of client program is show in screenshot on Figure 4 as:

RESULTS

When server and client is successfully run, then server is wait for client. When client is successfully connected to server then message and data is successfully passed to server and server is quickly replying to client. If this communication is implementing on any linux based hardware, this hardware is known as perfect communication hardware. The result of this communication is show in screenshot on Figure 5 as:

Model of Client-Server Computing

Client server model is a distributed arrangement, consist a two component, first is response or service provider called server and second is requester called client. This model is exchange the message in the form of request-response pattern by using inter-process communication and exchanges the data using cross platform [12]. Client and server communicate on separate device but reside under equivalent arrangement. In this work we use VMWARE for run a linux on window platform. VMWARE and virtual box is used for virtually run to linux on window same as physical hardware platform [13]. Following Figure 2 shows the structure of client server computing system as:

Table 1: Component Description of linux.

S.N.	Concept	Description	Examples
1	Utilities	Set of commands used by user	Ps, iostat, vmstat
2	Shell	Command interpreter and execute other program with provide user interface to system	Bash, Tcsh/Csh, Ksh, Zsh, Fish
3	Kernel	Core part of linux	Monolithic, microkernel, hybrid
4	Hardware	All physical or peripheral devices	CPU, RAM, I/O

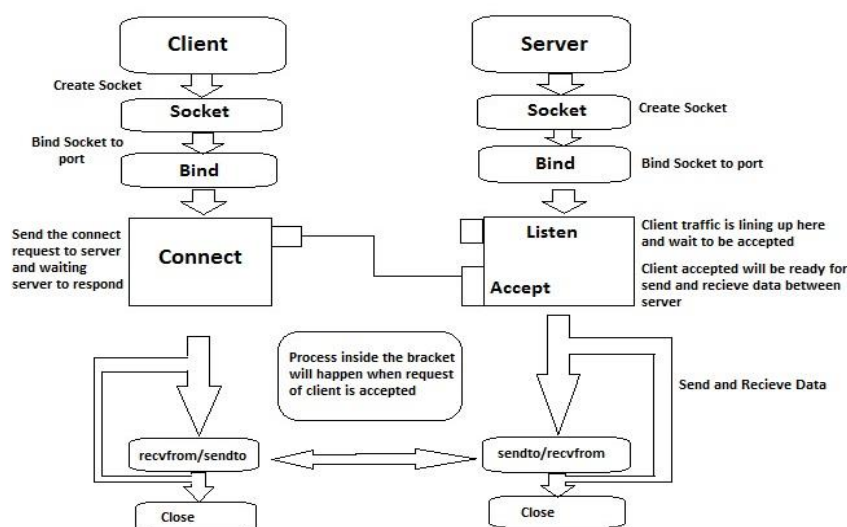


Fig. 2: Client-server system for smart device.

Table 2: Client server system using socket programming in 'C'.

Steps No.	Working for create a system	Methods in 'c'
Step 1	Socket create	#include<sys/types.h> #include <sys/socket.h>
Step 2	Socket Identify	int s = socket(domain, type, protocol);
Step 3	Server is wait for connect to Client	int connect(int socket, const struct sockaddr *address, socklen_t address_len);
Step 4	Request accept and client connect to server	int listen(int socket, int backlog); int accept(int socket, struct sockaddr * restrict address, socklen_t *restrict address_len);
Step 5	Communication	char buffer[MAXBUF]; ... nbytes = write(fd, buffer, 20); char buffer[MAXBUF]; ... nbytes = read(fd, buffer, MAXBUF);
Step 6	Close	int shutdown(int socket, int how);

Table 3: Review of Literature.

Authors & Journals	Descriptions	Research Gaps
Rahaman, A., et al., (2019), <i>Developing IoT Based Smart Health Monitoring Systems: A Review.</i> , Revue d'Intelligence Artificielle, 33(6), 435-440.	Discuss the review of IOT under health monitoring system. This review indicates the emergency services for any patient and use deep learning techniques on IOT [9].	Gap of this review is health monitoring system is applying on IOT for unwanted death and reduces health related problems.
Rao, R. N., & Sridhar, B. (2018, January). <i>IoT based smart crop-field monitoring and automation irrigation system. In 2018 2nd International Conference on Inventive Systems and Control (ICISC) (pp. 478-483). IEEE</i>	Propose the implementation of smart irrigation system on agriculture field for measurement to temperature and moisture of soil [10]. The information collects to system using sensors and raspberry pi board.	The research gap is improved the resource hardware, dynamic distribution, load balancing and efficiency using machine learning algorithm.
Yaghmaee, M. H., & Hejazi, H. (2018, August). <i>Design and implementation of an Internet of Things based smart energy metering. In 2018 IEEE International Conference on Smart Energy Grid Engineering (SEGE) (pp. 191-194). IEEE.</i>	Implement the smart energy metering fewer than two parameters such as power consumption and power line on IOT [11].	The research gap is developing smart system for reduce the cost of electricity and support to various programming platform as java programming, android and linux.
Lin, X., Lei, L., Wang, Y., Jing, J., Sun, K., & Zhou, Q. (2018, December). <i>A measurement study on linux container security: Attacks and countermeasures. In Proceedings of the 34th Annual Computer Security Applications Conference (pp. 418-429).</i>	In this review paper, study on measurement for linux container performance on industrial communication [12]. In this work focus on security under dataset attack with 223 exploits. =	The research gap is creating a security for core part under defect on 11 exploits.

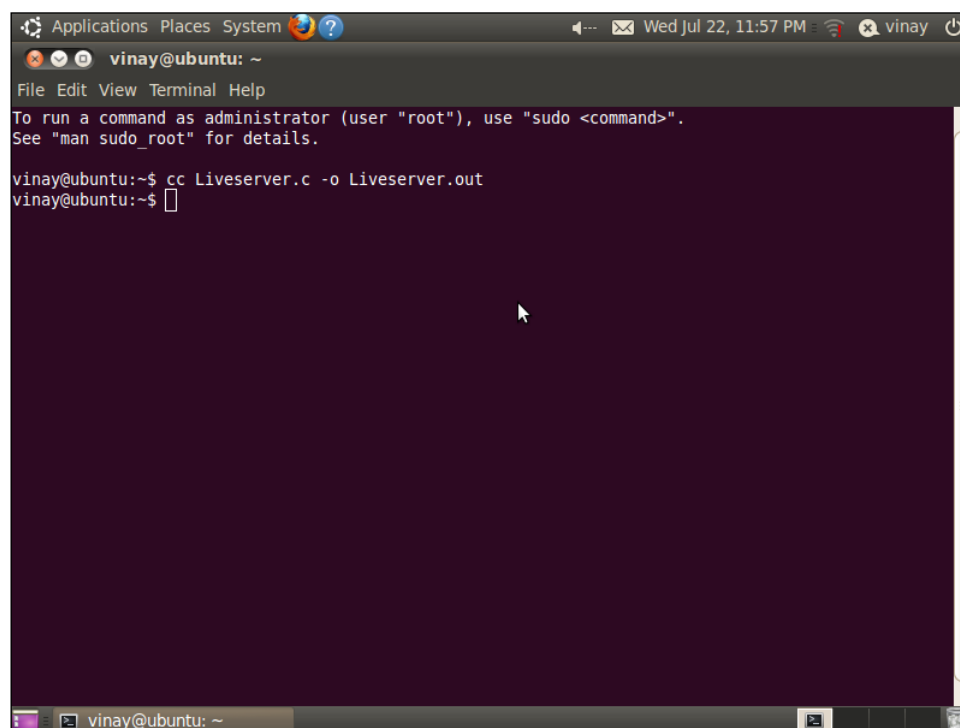
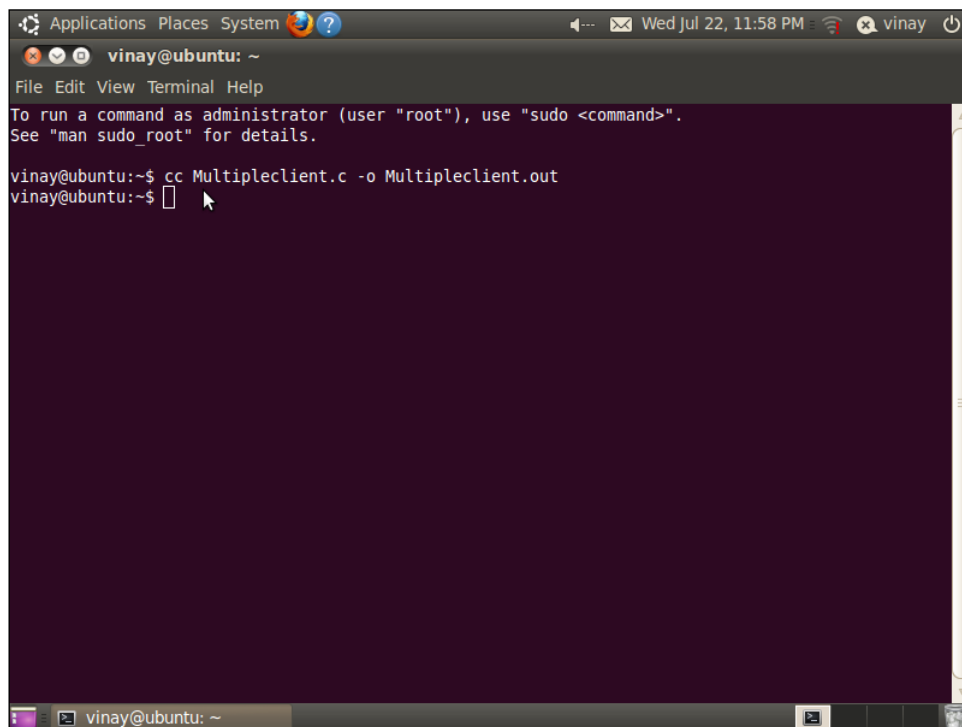


Fig. 3: Screenshot of Live Server for waiting a client.



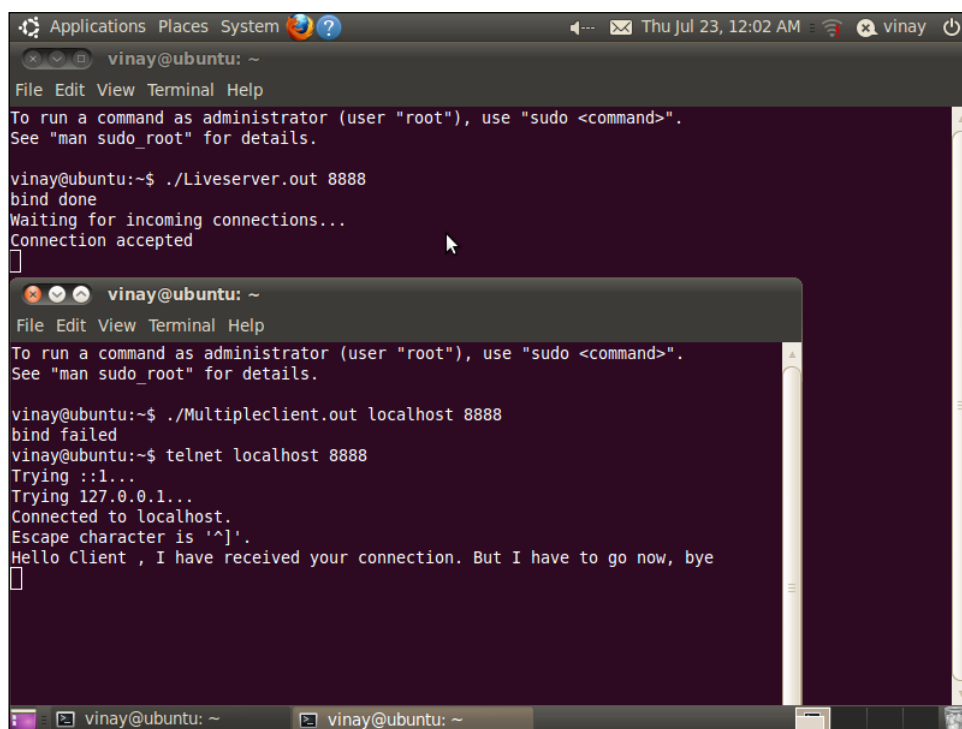
```

Applications Places System ?
vinay@ubuntu: ~
File Edit View Terminal Help
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

vinay@ubuntu:~$ cc Multipleclient.c -o Multipleclient.out
vinay@ubuntu:~$ 

```

Fig. 4: Screenshot of client for connectivity.



```

Applications Places System ?
vinay@ubuntu: ~
File Edit View Terminal Help
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

vinay@ubuntu:~$ ./Liveserver.out 8888
bind done
Waiting for incoming connections...
Connection accepted
^

vinay@ubuntu: ~
File Edit View Terminal Help
To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

vinay@ubuntu:~$ ./Multipleclient.out localhost 8888
bind failed
vinay@ubuntu:~$ telnet localhost 8888
Trying ::1...
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
Hello Client , I have received your connection. But I have to go now, bye
^

```

Fig. 5: Results of Client server communication.

CONCLUSION AND FUTURE SCOPE

In this paper we discuss the study of smart device with the features of linux related to IOT. This study is focus on communication like client-server on linux using socket

programming in 'c' and secures communication. In this implementation server is successfully connect to client and exchange the message with security. Future scope of this work is every features of linux which discuss on

this paper, implement on IOT and develop the smart hardware as well as smart device.

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