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DEVELOPMENT OF SECURED APPLIANCE AUTOMATION SYSTEM FOR

HOMES AND INDUSTRIES

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# ABSTRACT

This study developed a system for controlling home appliances remotely through mobile phones and investigated the performance of the system. This was with a view to reducing hazards resulting from the use of home and industrial appliances.

Two techniques for control of home appliances were developed. The first technique involved the secured control of appliances via the internet. A Java application was developed and installed on a mobile phone with a Java Virtual Machine (JVM) platform. The application was deployed into Java enabled phones, which communicates through a home server to an embedded system. The second technique involved the secured use of the short message service (SMS) which was developed as an alternative for situations when the internet and the Java application were not supported. The SMS-based control system was developed using a microcontroller-based control module that could both securely send and receive messages from a suitable mobile phone on the Global System for Mobile (GSM). The microcontroller was programmed to carry out the issued commands and then communicate the status of appliances back to the mobile phone. Frame Bus protocol was adopted and Assembly Language was used to enable the mobile phone to control the appliances using SMS. This operation was tested using MTN-Network for coverage distance and feedback response time for 30 samples control commands that gave the status of the appliances in the remote locations. Measurement to compare the effectiveness and efficiency of the SMS and the internet methods were taken, using Ibadan as the base station, at Ilorin (68km), Ife (68km), Lokoja (339km), Akure (193km), Abuja (555km) as remote locations.

The results obtained showed that the secured control of appliances via the internet took an average of 10.1, 10.3, 10.2, 11.0 and 10.0 seconds, respectively; while the average response time for SMS were 8.1, 8.0, 8.3, 8.2 and 8.0 seconds, respectively. It was observed that the internet-based method lagged behind the SMS-based technique by a minimum of 2 seconds. This is due to the longer route and higher hierarchy traversed by the former. Furthermore, the SMS control method has about 2% failure rate. The user name

and password was preconfigured, if the authentication is wrong the phone will logout the control application automatically.

This study concluded that the developed system is highly reliable due to the low failure rate achieved, and a minimum propagation delay when sending command. The techniques developed will help to secure and control home and industrial appliances remotely.

**Keywords:** Home appliances,Mobile Phones, Java Virtual Machine, Global System for Mobile, short message service, MTN-Network

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# CHAPTER ONE

# INTRODUCTION

## 1.1 Background to the Study

The early 1980's witnessed a greater drive towards the realization of the "smart home" .The main concept of smart houses was to enhance and offer a more comfortable home, with better energy saving system and better security for residents (Dimitar *et al.*, 2004).

In the twenty first century, it is evident that Internet usage has risen dramatically, to a point that it has become part of our daily lives. Current technologies show that home automation is ready to move to the next stage such that in the next few years, the growth of the control of home (electrical and electronics) devices over the internet is expected to grow exponentially. At this time, ordinary individuals/citizens of countries want to control their devices via the internet.

Some envisaged challenges to this trend in the present day world includes fire accidents, which often resulted in devastation to various degrees, due to inappropriate handling of home appliances and/or electrical devices. These ugly home incidents may occur where the occupants have had to travel to long distances without remembering to switch off their electrical and electronics appliances. Another scenario may be due the erratic events frequently associated with the generation, transmission, and distribution of electricity supply in some countries. Furthermore, a poor handling of home appliances on the part of the users or a deliberate act by an arsonist could also result in the loss of lives and valuable properties.

These challenges have necessitated the current research work, thereby exploring and experimenting with options for controlling home appliances with the internet. It is likely that most of the homes will be equipped with home automation systems in the very near future (Alkar and Buhur, 2005).

## 1.2 Need for Automation System.

The security of appliances in homes and industries against unauthorized access, poor handling, abuse, etc. has been a major issue of concern to governments in the world due to the increasing level of crimes associated with it. This coupled with the fact that everybody wants to take proper measures to prevent intrusion and/or unauthorized access to appliances, and challenges posed by present day socio-economic activities has resulted in the need for a concern to ensure safe and proper use of appliances. These challenges and the gap in the economic well-being of citizens have challenged this study to seek for simpler, cheaper, secured, and viable alternatives to the provision of appliances in homes and industries.

The adoption of appliances' automation is to give users more control over certain things that require constant attention irrespective of the distance from any part of the world. Data via internet can flow from machine-to-machine, and could ultimately lead to exchange of information or data between machines and human beings.  Regardless of the type of machine or data sources, information usually flows from a machine over a network, and then through a gateway to a system where it can be processed and analyzed.  Automation devices will therefore bring about a cost reduction, (e.g. the cost of labour that control or check machines will be