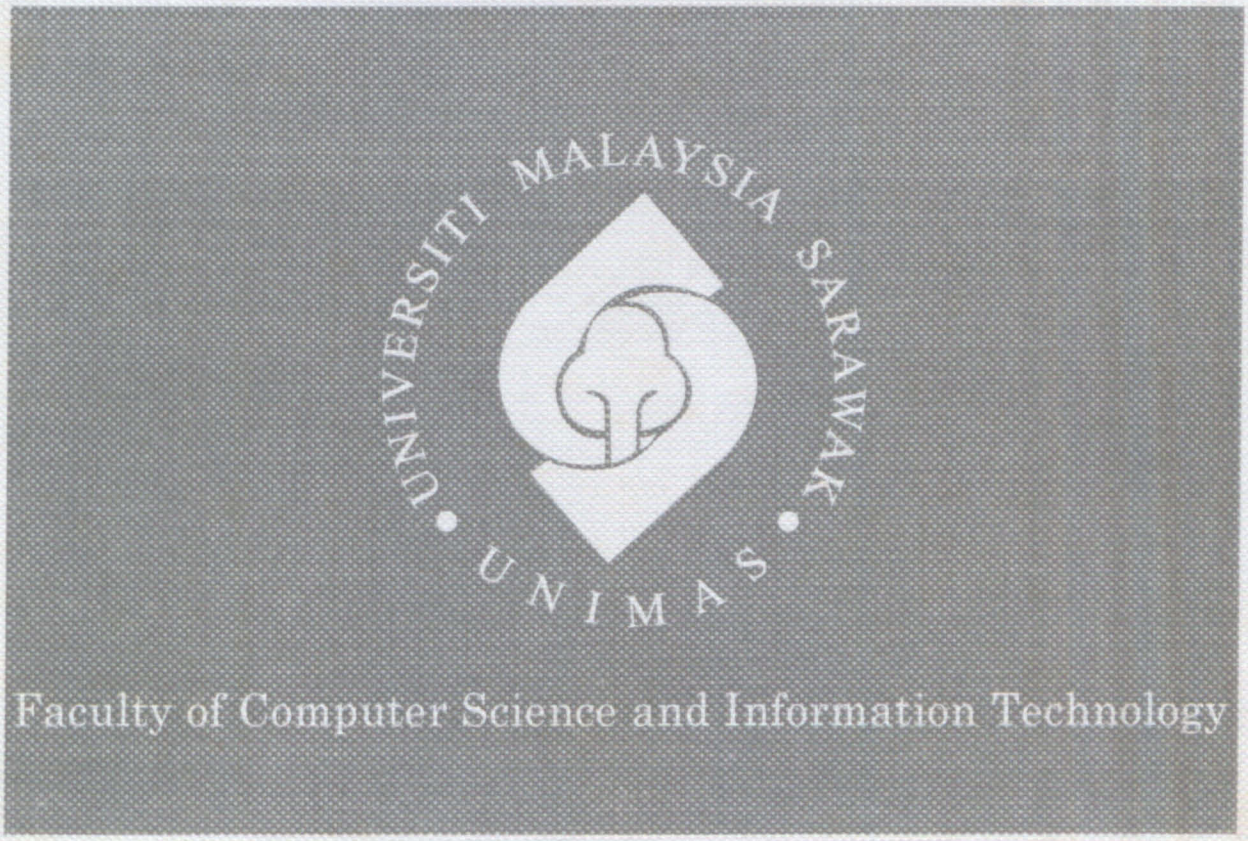

TELECENTRE NETWORK CONNECTIVITY MONITORING SYSTEM

Peng Hongjing

Bachelor of Computer Science with Honours
(Network Computing)
2014

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PENG HONGJING

This project is submitted in partial fulfilment of the

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LIST OF ABBREVIATIONS

NGOs	Non-governmental organizations
ICT	Information and Communication Technology
VSAT	Very Small Aperture Terminal
TNCMS	Telecentre Network Connectivity Monitoring System
CMS	Central Monitoring Station
UNIMAS	Universiti Malaysia Sarawak
ICMP	Internet Control Message Protocol
LRWRS	Long Rang Wireless Relay Stations
RFC	Request for Comments
SNMP	Simple Network Management Protocol
MIB	Management Information Based
RMON	Remote Network Monitoring
MySQL	My Structured Query Language
RMON	Remote Network Monitoring
RTT	Round Trip Time
SDLC	System Development Life Cycle
TCP/IP	Transmission Control Protocol/ Internet Protocol
TTL	Time-To-Live
FAMPP	FreeBSD, Apache, MySQL, PHP and PHPMyAdmin

ABSTRACT

Recently, the number of telecentres is increasing in the rural areas. Instability in the telecentre network will break all of the top communications as the satellite connection is liable to disruptions. The Telecentre Network Connectivity Monitoring System (TNCMS) is a computerized system that will continuously monitor the stability of the rural telecentre network. Using this system the potential connectivity problems can be identified and discovered effectively and a network administrator will take measures if necessary. Ping is the most common and simple method to test an Internet Protocol (IP) network availability and connectivity. The ping application combined with an embedded device (such as Raspberry Pi) used to collect data from multiple nodes of the telecentre network simultaneously and send report to the Central Monitoring Station (CMS) for processing, and the CMS web services will display the monitored information and represent the information. Through the analysis of existing telecentre network model, two system portions, the Connectivity Tester Application and the Web Connectivity Reporter Application will be developed at this client-server environment to implement the TNCMS for long-term monitoring, and provides the foundation to network administrator for control of the telecentre network.

Keywords- Telecentre network; connectivity monitoring; embedded device

ABSTRAK

Baru-baru ini, bilangan telecentre semakin meningkat di kawasan luar bandar. Ketidakstabilan dalam rangkaian telecentre akan memecahkan semua komunikasi atas sebagai sambungan satelit yang boleh menyebabkan gangguan. Telecentre Network Connectivity Monitoring System (TNCMS) adalah sistem berkomputer yang akan terus memantau kestabilan rangkaian telecentre luar bandar. Dengan menggunakan sistem ini, masalah sambungan potensi boleh dikenal pasti dan ditemui secara berkesan dan pentadbir rangkaian akan mengambil langkah-langkah jika perlu. Ping adalah kaedah yang paling biasa dan mudah iaitu dengan menguji Protokol Internet (IP) ketersediaan rangkaian dan sambungan. Aplikasi ping digabungkan dengan peranti terbenam (seperti Raspberry Pi) yang digunakan untuk mengumpul data dari pelbagai nod rangkaian telecentre secara serentak dan menghantar laporan ke Central Monitoring Station (CMS) untuk diproses dan perkhidmatan web CMS akan memaparkan maklumat yang dipantau dan mewakili maklumat. Melalui analisis model rangkaian telecentre yang sedia ada, dua bahagian sistem, Connectivity Tester Application dan Web Connectivity Reporter Application akan dibangunkan di persekitaran ini pelanggan-pelayan untuk melaksanakan TNCMS untuk pemantauan jangka panjang, dan menyediakan asas ini untuk membina rangkaian pentadbir untuk kawalan rangkaian telecentre ini.

Rangkaian Keywords- Telecentre; pemantauan sambungan; peranti terbenam

CHAPTER 1
INTRODUCTION

1.0 Introduction

This is the first chapter which gives a general introduction to the project topic. In this chapter, it describes the background of the project, problem statements, objectives, scope of the project, significance of the project as well as the structure of the project and conclusion.

1.1 Background of the Project

In recent years, there are a number of telecentres being set up by the Malaysian government departments and non-governmental organizations (NGOs) in the rural areas. These areas cover remote and isolated areas that previously were lacking connectivity to the world's information society. The rural areas are frequently considered as information-poor in which providing information has been a central factor for their development. As a kind of Information and Communication Technology (ICT) projects which are based on local information and communication resource centers, telecentres provide the benefits of new communication technologies to the rural areas. In general, the telecentre is a community centre with computers and satellite communication technology to get access to the Internet. In addition, a solar-powered VSAT (Very Small Aperture Terminal) supply is implemented for the telecentre so that it could be used in rural areas with insufficient power infrastructure.

With the rapid development of automatic control and computer network technology, it has been possible to realize remote network monitor and control. As a means of finding out network malfunction and potential problem, the Telecentre Network Connectivity Monitoring System (TNCMS) has been proposed. The system being proposed monitors the existing telecentre network connectivity by attaching an embedded device in the telecentre through the Central Monitoring Station (CMS) in a client-server environment. Once implemented, the system may be tested out in the Bario telecentre which is under the management of Universiti Malaysia Sarawak (UNIMAS).

The Telecentre Network Connectivity Monitoring System (TNCMS) is a computerized system that could automate as much of the monitoring telecentre network connectivity dynamically. Within the telecentre network the embedded device such as Raspberry Pi is used to collect data from multiple nodes simultaneously and send report to the Central Monitoring Station (CMS) server for processing. Then, the CMS web services will display the monitored information and analyze the received information. Through the analysis of network model of telecentre, the connectivity tester software is implemented via TCP/IP (Transmission Control Protocol / Internet Protocol) and ICMP (Internet Control Messages Protocol) to continuous monitor the connectivity of telecentre network, and provides the foundation for control of the telecentre network.

1.2 Problem statement

The telecentre network provides convenience and benefits for people in the community at the same time, it also makes people face various challenges. Problems with network communication can cause the telecentre to be unusable. The intermittent problem with the Internet connectivity is the main issue of telecentre network as the satellite connection is liable to disruptions. Instability in the telecentre network will make all of the top communications to be broken. The main method of improving the network stability is to diagnose the fault of the working network in time and instructing the telecentre manager's decision. For guaranteed the normal supply of power for the telecentre network, an innovative hybrid system of solar panels and a diesel generator should be used to supply uninterrupted electric power. But because of insufficient power infrastructure in

the community, this system is supplied by solar-powered VSAT, which is low power consumption.

Besides that, continuous monitoring of the network's connectivity is another issue of the telecentre network. Due to lack of technicians, the telecentre mostly is operated by only a manager who is graduate or local candidate. The roles and responsibilities of a telecentre manager include sensitizing the community about the services provided by the telecentre, promoting telecentre usage among them, conducting ICT training and reporting computer hardware and software faults to facilitate speedy maintenance, communicate with the local authorities, attract local entrepreneurs, help private companies and so on (TelecentreMagazine, 2009). The telecentre manger cannot possibly engage in the monitoring work fully the whole day even if he was assumed to be able to handle the telecentre all by himself. However, it would be better for the telecentre manager to reduce the workload if the monitoring work can be automated, which could be feasibly solved by this proposed project.

Also, maintenance restriction can be a problem in telecentre network, the maintenance of the equipment to ensure good operation and condition can be very challenging. The inspection or monitoring of the telecentre equipment can be a time consuming task and may be hard to be carried out at the appropriate time, either daily or weekly. Having hard time in accessing the telecentre site, an auto alert system can be implemented to notify the server centre for any fault, this can ease the overall maintenance work. Due to the financial problem that might be face by the developers of the telecentre given to the fact that it is a government project or NGO which does not require much income from the rural area. This

will lead to lack of financial resources in rural telecentre project, given to the fact that the rural people are not financially buoyant to support the maintenance of the telecentre infrastructure.

For maximum telecentre network effectiveness, a central monitoring and control function for telecentre network is necessary.

1.3 Objectives

The objectives are divided into two categories which are the general objective and specific objectives that must be met in the development of this system. The general objective of the project is to design and develop a Telecentre Network Connectivity Monitoring System (TNCMS) to continuous monitor the stability of the rural telecentre network and analysis potential connectivity problems through the Central Monitoring Station (CMS) in a client-server environment. The specific objectives of this project are:

1. To adopt an embedded device for automatically start remote monitoring Telecentre network nodes;
2. To design and develop a network connectivity tester application to collect data from multiple nodes simultaneously and report to the CMS;
3. To configure and set up a data collection web/database server at the CMS to store and retrieve the monitored information; and
4. To develop a web connectivity reporter application to provide summary screen and graphical presentation, and allow access to the CMS data and settings.

1.4 Scope of the Project

This project aims to develop a network connectivity monitoring system in telecentre that provides real-time monitoring, an easy web-interface, historical data, availability reports and performance text. This Telecentre Network Connectivity Monitoring System (TNCMS) is a two-part system, the client-end and the server-end. The client-end is made up of the embedded device and the connectivity tester application is responsible for monitoring network nodes, data collection and reporting to the CMS. The server-end which is a Web service on the CMS is responsible for data presentation. This database on the CMS should be updated dynamically. It can be widely used in the telecentre network that links up various surrounding villages via the Long Rang Wireless Relay Stations (LRWRS), and access the outside world via Internet gateway.

1.5 Significance of project

The significance of this project is the implementation of connectivity monitoring in telecentre network. This project will help in the long-term monitoring the stability of the rural telecentre network and analysis the monitored information received from the embedded device to identify and discover connectivity problems, and give the basis foundation to control the telecentre network. System studies described in this paper have shown that it is applicable to remote monitoring multiple network nodes simultaneously in the rural telecentre, and provides rapid and efficient network reaction to natural and man-made disturbances.

1.6 Excepted outcome

In the end of this project implementation, this system is expected to continuously monitor the telecentre network connectivity. The Telecentre Network Connectivity Monitoring System (TNCMS) will be implemented by using the embedded device with connectivity tester application to automatically start remote monitoring telecentre network nodes, and collect data from multiple nodes simultaneously and report in text form to the CMS. Other functions of TNCMS are to provide summary screen and graphical presentation, allows access to the CMS data and settings on the web service. By selecting a node of the telecentre network, the CMS network administrator could monitor this network node connectivity between the telecentre and the Long Rang Wireless Relay Stations (LRWRS), and the Internet gateway.

1.7 Project Schedule

This project was implemented within eight months. Schedule has been made to ensure that the project finish on time. The following is the project schedule time (Table 1.1):

Table 1.1: The proposed time schedule

	Task Name	Time Period
Semester 2-2013/2014	Chapter 1 Introduction	1 Month
	Chapter 2 Literature review	1 Month
	Chapter 3 Methodology	2 Months

Semester 1-2014/2015	Chapter 4 Implementation and Testing	3 Months
	Chapter 5 Conclusion and Future Works	1 Month
Total		8 Months

1.8 Chapter Outline

This project consists of five chapters, which are introduction, literature review, methodology, implementation and testing, conclusion and future works.

The Chapter One mainly discussed about the introduction of my project studies based on the background of the project, problem statement, objective, project scope and the significance of project.

The Chapter Two focused on the literature review. This part of the chapter discussed about the work that had done by the previous researchers. Hence, literature review acts as a reference for my project study.

The Chapter Three mainly described about the project methodology by mentioning the hardware and software that were needed for designing and developing the systems. It also includes the conceptual of the design, system architecture and system flow.

The Chapter Four discussed system design and development. In this chapter, it introduced the development of the system from one stage to another stage. Besides that, it also included a brief explanation on the functions involved in the system and screen shots of the system output.

The Chapter Five was the discussion and conclusion of this project. It was mainly included about the conclusion made for the overall project. Some recommendations for the future work were also included in this final chapter.

1.9 Summary

In conclusion, this chapter has briefly introduced the background of the project, problem statements, objectives, scope of the project, significance of the project, and the structure of the project. The following chapter put the highlights on the literature review that related to this project.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

This chapter presents the literature and technical reviews related to the project. Some works and research done previously will also be discussed in this chapter, in which the reviewed techniques can be applied in developing the proposed system in the later phase.