MICROCOMPUTER SYSTEMS

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BY

YOUSRY SAPER EL-GAMAL
B.Sc. Electrical Engineering

SUPERVISED BY

Dr. M.A. Hessan
Prof. & Head of
COMPUTER & CONTROL LAB.
ATOMIC ENERGY ORGANISATION

Dr. M.A.R. Ghonaimy
Assistant Prof. ELECTRICAL DEPT. FACULTY
ENGINEERING, AIN SHAMS
UNIVERSITY.

Examiners

M-A-R. Ghonaimy

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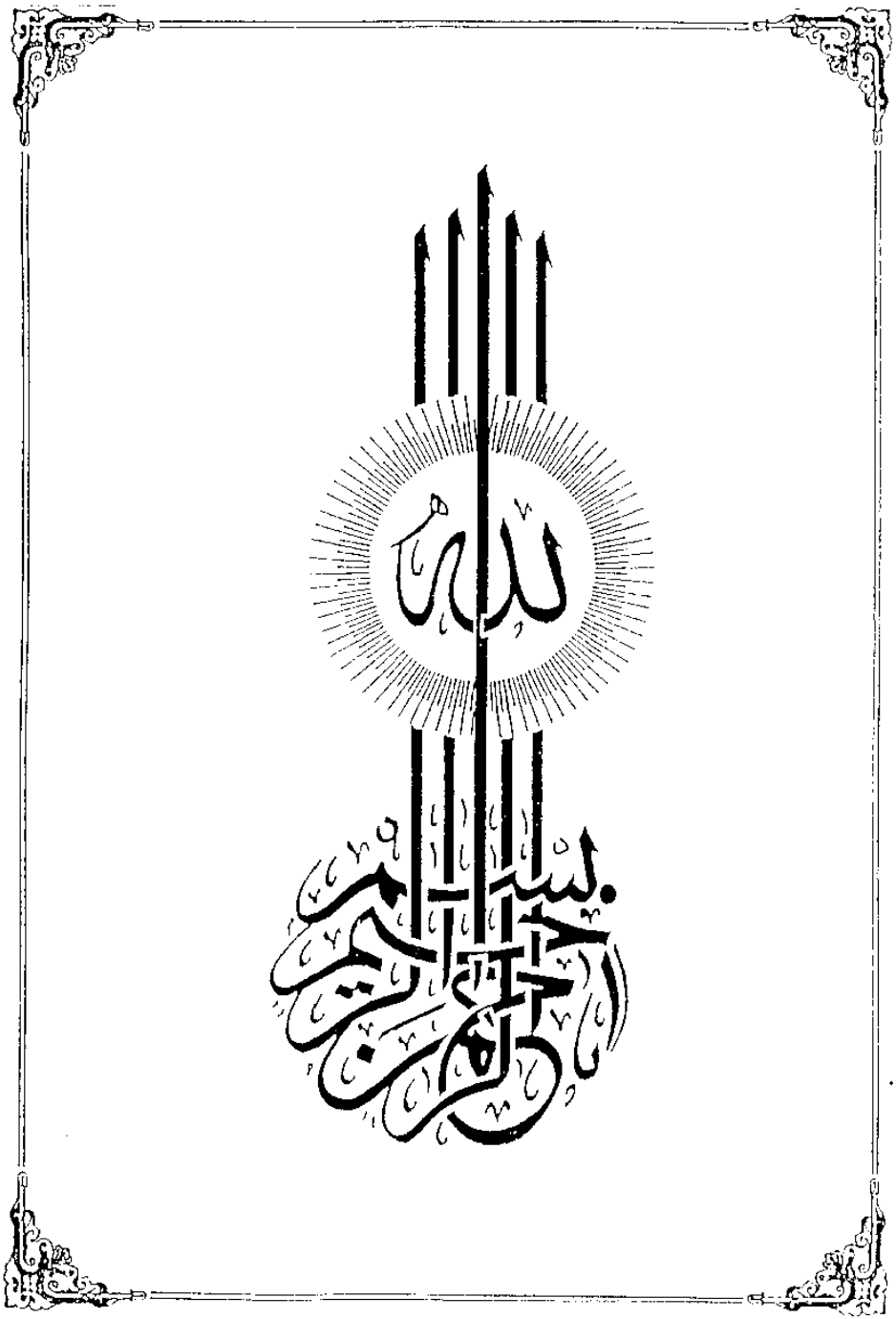
IN DEDICATION TO MY PARENTS



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Summary Of The Thesis Presented To The Electrical Engineering Department, Faculty Of Engineering, Ain Shams University For The Degree Of

MASTER OF SCIENCE

Title : Multicomputer Systems

By : Yousry Saber El-Gamal.

The thesis is a study of the communication software related to interprocess communication used for multicomputer systems, as well as the realization of a communication protocol between two intelligent nodes for a high reliability data communication network. The thesis includes a discussion about the aspects of communication software and the operating system structure used for data communication. Problems related to establishing and maintaining connection between different computers in a multicomputer system is solved by establishing a set of rules for intercommunication known as protocols. A study about the communication protocols for different network configurations was performed

to emphasize the functions and main features of these protocols. Due to the significant advance in microprocessor technology, it was convenient to use such aprocessor as an intellegent node to perform the functions of a communication interface between two host computers. The thesis presents the complete description of a node-to-node communication protocol showing the establishment of connection, information flow control and error detection and correction.

The microprocessor is the main source of intellegence for the node since it performs the functions of subdividing messages-received from its local host-into blocks, adding the proper header for each block and testing for the common bus availability before starting any transmissions.

In the receiving mode, the node performs an error check operation on each block asking for the erroneous blocks to be retransmitted. Moreover, the node is designed to perform a sort of decision making in case of job bidding without referring to its local host.

The realization of the above mentioned protocol was realized using an INTEL-8008 microcomputer together with the associated special logic circuitry. The listing of the node program is also given in INTELLIC-8 assembly language.

CONTENTS

1.1. Scope of the Work

Computer systems may be divided into three broad and overlapping categories, real-time systems where there is a strict upper limit on the time within which the computer must deal with signals from a number of different input channels, quasi real-time systems where the failure of the computer to respond causes annoyance rather than disaster, and batch-processing systems where the response is not at all critical and jobs may be scheduled to use the resources of the computer, to best advantage.

In all these categories it is a common requirement to site the various terminals or other peripheral devices which are served by the computer at sites remote and often widely seperated geographically. Hand in hand with the development of these remote access systems has gone the development of communication facilities, without which it would be impossible to operate.

At first, the Telex and Telephone networks were used to get information from remote points to a central computer, and as the sophistication of the system increased the techniques for using Telephone channels was developed until eventually, expensive private networks of leased lines carrying digital information between computers and remote peripheral devices became established. The development of such networks as the volume of data traffic began to increase eventually led to the idea that data networks shared between a number of computer systems would be more economic and thus the possibility of public data communication networks.

A breif description of development of communication networks is given at the first part of this chapter, followed by a discussion to the essntial motivations that led to the evolution of such networks. The different approaches and main considerations taken in designing data networks are also exposed in this chapter.

Although we commonly talk about communication taking place between computers, it is of course the programs within the computers which interact with each other. More particularly it is the processes in one machine that have

to interact with processes in the other, ideally, this should occur in a similar manner to the way processes situated within one computer interact with each other. The future importance of the specialized networks now being developed for connecting computers lies in the facilities they will provide for efficient interprocess communication between processes situated in several computers. As techniques and standerds are developed which facilitate this kind of interaction through a data network, it will be possible to build computer systems which differ markedly those available today.

Chapter (2) deals with communication software. The hardware considerations taken in the design of software as well as the basic aspects of communication softwere are discussed in this chapter. The concepts of parallel processing, definition of the process and interprocess communication is also dealt with. The last part of chapter (2) is devoted to the discussion of the structure of the operating systems used for data communication applications.

In order to enable and control the interaction between different network components in such a way that this interaction goes smoothly & without errors, it is essential to

have sets of rules that govern the whole process. These rules are called communication protocols which is the subject of chapter(3). An introduction to communication protocols is discussed using a general-purpose network to show their main features, followed by a detailed description for three examples of the existing protocols for three different networks namely,the advanced Research Project Agency(ARPA) network, the synchronous Data link Control(SDLC) developed by IBM & the Distributed Computer System(DCS) network. The realization of the node-to-node communication protocol is presented in chapter(4). The first part of this chapter is devoted to a discussion of the aspects of controlling a complex process which leads to the concept of high reliability distributed computer network(HRDCN) architecture. A brief description to the overall structure & performance of HRDCN is presented followed by the hardware design of the node around the INTEL8008 microprocessor. A detailed description to the software design of the node-to-node communication protocol together with the associated flow charts is given in this chapter & the operation of the node in the different phases of communication is exposed.

As the realization of the protocol was done using the INTELLEC-8 assembly language, Appendix A describes the general architecture of INTEL 8008 with a presentation to the instruction repretoire of this micro computer.

Appendix B gives the detailed description of the memory loyout of the INTELLEC-8 in addition to the detailed flow-charts of node coeration.

Appendix C includes samples of the program listings in INTELLEC-8 assembly language concerning the node-to-node communication protocol.

Appendix D explains the concept of the Cyclic Redundancy Check (CRC) used for error detection in the protocol under consideration.

1.2. The Development of Computer Networks.

The first attempts to establish a computer network was done simply by connecting a number of remote terminals to a single computer. To achieve this, the first step was to use telegraph lines or telephone lines with modulators &