National Institute of Electricity and Electronics

INELEC - Boumerdes

DEPARTMENT OF RESEARCH

THESIS

Presented in partial fulfilment of the requirements of the

DEGREE OF MAGISTER

in Applied Electronics

by

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A Microprocessor-Based Multiplexed System for Automotive Industry

Defended on april 21, 1991 before the jury :

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oOo DEDICATION oOo

To my mother

To the memory of my father

To my nephews Redouane and Jalal

To all my family

I dedicate this work.

ACKNOWLEDGMENT

I would like to express my great debt to my supervisor and teacher, Dr. B. J. AL-LAMI, for his continuous help, suggestions and supervision during the whole period of this project development.

A special note of appreciation is due to the Postgraduate Studies Officer, Mr. A. MOUFEK, for his unlimited support to the final success of our work.

My sincere gratitude is due to Dr. TEDJINI BAILICHE Hacene (U.S.T.H.B.) for his acceptance to be the President of the Jury.

My thanks are due to Dr. K. HARICHE (INELEC) and Dr. M. DIAF (University of Tizi-Ouzou) for their kind acceptance to be members of the jury.

I wish to express my great debt to Dr. H. BOURDOUCEN for his detailed proofreading of the manuscript, his fruitfull suggestions and his acceptance to be a member of the jury.

My thanks are due to Dr. M. O. TOKHI from the department of control engineering, University of Sheffield, for his acceptance to be a guest member of the jury.

My gratitude is due to Mr. A. BENAZZOUZ, Director General, Mr. A. HAMDI, Dean of Studies and Pr. V. MITRA for their continuous interest to the project.

I would like to thank Dr. S. BANKS, Dr. A. MORRIS from the department of control engineering (University of Sheffield), as well as Dr. B. CHANANE for their assistance and interest during my training in the University of Sheffield, England.

This project could not be achieved without the contribution of the National Company of Industrial Vehicles (SNVI-CVI), namely, Mr AMAZIT, Mr D. MAHIOUT from the 'Unité Etudes et Recherches' department and all the team of (U.E.R.) technicians.

Coming back to INELEC, I would like to acknowledge the support and help provided by Mr. B. OUHAB and Mr. D. BENAZZOUZ.

The encouragements of Mr. Y. HAMADA, Mr. A. BOUKLACHI, Mr. Z. SARI, and all other INELEC faculty were welcomed. The help provided by Mrs F. ZERARI and all the library staff is greatly appreciated.

I could not close this acknowledgment without expressing my sincere gratitude to two persons to whom I owe a great deal. The sacrifice, moral support and efforts, made by my unique brother MOSTEFA and my fiancée Miss A. SIFI to encourage me achieve this work, were of great benefit.

My appreciation and gratitude are due to all other persons who contributed in a way or another to the final success of this project.

This thesis report describes a modern alternative solution to the wiring complexity problem by introducing multiplexing techniques which consist of replacing the conventional wiring harness by another system that highly reduces the number of conductors being used, provides monitoring tools, and exhibits high reliability and simplicity of installation and service.

The importance of the multiplex system is growing as a means to solve the various problems related to vehicle harness, and a variety of multiplexed wiring solutions have been proposed throughout the world. However, due to the highly competitive nature of the automotive market, only few things, such as system characteristics, could be known about the already or being developed prototypes. In fact, apart from some standard requirements of multiplexed systems and some solution approaches such as the Society of Automotive Engineers J1850 SAE, each car manufacturer is concealing the details of its proposed solutions thus making attempts for comparative study very difficult.

This report has been subdivided into seven chapters. Chapter I sheds some light on the early beginning of multiplexing in motor vehicles and its development. It also gives a brief discussion about the requirements and the criteria to be fulfilled by a multiplexed system. The last part describes the different classes of multiplexing as defined by the Society of Automotive Engineers.

Chapter II discusses theoritical design aspects from constraints to strategies as well as it gives a general description of the different network topologies.

A general description of the INELEC Multiplexed System (IMS) along with an extensive coverage of the system hardware (master and slave) are given in chapter III.

Chapter IV discusses the communication protocol, data integrity, reliabilty and recovery within the system. Namely classes of failures, error detection, diagnosis and recovery are presented.

Chapter V provides a description of the system interfacing and its prototype implementation based on the electrical system of a '25L4' type minibus provided by the Algerian Company of Industrial Vehicles (SNVI). Also, it gives an idea about the state of the art in the field of intelligent power switching.

Chapter VI discusses the different software routines developed within the system from the master as well as the slave control units side.

Chapter VII concludes this thesis report with a brief discussion of future technology and suggests different points for further work.

PREFACE

The increasing number of electrical and electronic units being used within a motor vehicle as well as the growing need for monitoring systems, has caused the number of cables to carry these signals and feeds to increase. Consequently, the electrical systems of most motor vehicles are becoming more complex with a resultant considerable increase in the wiring complexity and the difficulty of installation. Although these cables are tied together to form a compact harness, the bulk, and weight of the looms and connectors makes accomodation difficult. In addition, the grouping together of supply cables often causes the cables at the center of the loom to overheat; as a result of the increase in total harness resistance, the efficiency of the system is lowered.

One solution to the problem, is to use a remote switching system. This system, which has been in use during recent years, uses a common power cable and numerous signal cables to control the switching devices. Switching is normally performed using relays. The signal cable to each relay only carries a small current so the cables can be smaller, in diameter size, than those originally used. This solution still suffers wiring complexity and the total length of the cables used is still high.

ABSTRACT

There are many applications where modern control systems are becoming more and more sophisticated with a resultant increase in the complexity of wiring interconnections.

This complexity is due to the requirement of one or more conductors to connect the control panel to each specified function. These connectors are to carry power, control and monitoring signals to remote locations.

One of these applications is the electrical wiring interconnection of a motor vehicle. Although there are many different systems as there are car manufacturers, it is still a common interest for all to replace the present conventional, costly and non-intelligent system by another that highly reduces the number of conductors, increase intelligence and easy to install and service.

The aim in this study is to design and develop an electronic switching and monitoring system based on the multiplexing of digital codes by local control station and remote monitoring units. The system is to use the suitable VLSI and power devices to build a prototype that could be useful product to the Algerian Car Industry.

Keywords: Multiplexing, microprocessor L.A.N., vehicle harness.

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