MICROPROCESSORS—NO LONGER A NOVELTY

Since the 1971 introduction of the first commercial microprocessor by INTEL, almost every major semiconductor manufacturer has introduced or has under development a "microprocessor" type of device. Microprocessors will be available in most of the existing and future high volume technologies, including PMOS, NMOS, CMOS, Bipolar and PL. Microprocessor chips range from 2 or 4 bit slices for Bipolar devices, through 4, 8 and even 16 bit MOS microprocessors on single chips.

Considerable debate is still raging regarding the subtle distinctions between calculator chips, microprocessors, and multi-LSI chip minicomputers. Suffice it to say, that whichever of these three classes of devices one is contemplating using in a given application, many of the major design tradeoffs and system advantages (programmability, flexibility, maintenance, and cost) apply equally well. Microprocessors are no longer a novelty, and the list of products that employ these devices is growing longer every day. It has become almost impossible to pick up a trade journal without coming across several new developments relating to microprocessors. For these reasons, it was felt appropriate to organize a session dedicated not to hypothetical applications and paper designs, but to real world systems that are currently being implemented. Several articles have recently explored the vigorously developing microprocessor applications areas.

OVERVIEW OF FORMAL PAPERS

The first paper of this session, entitled "The Synergistic Combination of an Oscilloscope and a Microprocessor," by Walter A. Fischer of the Hewlett-Packard Company, explores the use of microprocessors in instrumentation applications. The HP1722A oscilloscope is not the first commercial instrument to utilize a microprocessor, but it represents a major advance to an instrument that has traditionally been the engineer's right hand, and whose basic operation has not changed in many years. As such it typifies what will undoubtedly be a new instrumentation design philosophy.

The second paper of the session entitled "Development of a Portable Computer for Industrial Microcomputer Systems," by Dr. Leroy H. Anderson of the Warner and Swasey Company, covers potential applications of microprocessors in numerical and process control, and defines a unique English-like process control language (PCL), along with a portable PCL compiler highly suited to process control applications. The development of the PCL language may point to a novel approach to microprocessor software development in which the use of high level languages tailored to specific applications will greatly simplify the development of specific system designs.

The sessions' third paper, "Microprocessors in CRT Terminals," by John Whiting and Sandy Newman of Beehive Medical Electronics, covers the broad area of microprocessor applications to CRT terminals. Tradeoffs regarding both the use and choice of microprocessors are discussed. An excellent perspective of what microprocessors can and cannot do in a CRT environment is presented. The trials and tribulations associated with program development and debugging are discussed openly and candidly, and several useful debugging tools are detailed.

The final formal paper of the session, entitled "Designing an Application Oriented Terminal," by J. P. Kohli of the NCR Corporation, describes the Honeywell 7340 bank teller terminal. The 7340 is a microprocessor-based application oriented terminal for the banking industry, and as such, illustrates a typical terminal application where local intelligence facilitates the processing of transactions. Many of the decisions relating to real time processing, customer programming and system architecture are succinctly described.

MICROPROCESSOR-BASED DATA COMMUNICATIONS SYSTEMS

The one major microprocessor application area that has not been adequately covered by the four formal presentations, is that of data communications. Considerable development work is ongoing in the use of microprocessors in narrowband store-and-forward communications systems in intelligent Repeaters associated with digital communications links, and in various switching and monitoring applications where the power and cost of minicomputers is not warranted.

Prior to the panel discussion, Dale Walls, of Collins Radio, will present a brief overview of this burgeoning area of microprocessor applications.

* Mr. Kohli was with Honeywell Information Systems, Inc. at the time this paper was written.
RECENT DEVELOPMENTS

The trade journals abound with examples of recent microprocessor-based systems. From assembly line torque monitoring in Detroit (Intel 8080), to the intelligent oscilloscope (HP1722A), to traffic light control (Intel 8008), to a large number of microprocessor-based data terminals (TI742, HP2640A, Beehive Medical Electronics, etc.), and finally to arcade/restaurant TV games, microprocessors are increasingly becoming a part of our daily lives.

The next step beyond a microprocessor-based system is one employing several processors. Several such products already exist. Financial Data Sciences, Inc. Model 108 teller terminal consists of three MCS-4 cpu's. One cpu controls the printer, another controls the keyboard and performs all the required calculations, and another provides stand-alone processing should the communications link to the main cpu fail. Another example is the OP-1 CRT terminal from Ontel. It sports an Intel 8008 as the central processor and uses two other (TTL MSI) processors to control the I/O and keyboard/display operations. These multi-microprocessor systems are but a preview of what will surely come.

FUTURE APPLICATIONS

As microprocessors evolve, and price/performance improves, many new applications areas will emerge. The upper end of the microprocessor performance spectrum will be used to implement many systems currently employing minis, and may also be used in the development of programmable high performance peripheral interfaces. The use of medium range microprocessors will accelerate in the various industrial applications areas typified by the applications presented in this session. Potentially, the real dollar growth in applications will occur in the consumer and automotive areas, where the lower end of the microprocessor performance spectrum should prove more than adequate to satisfy the requirements of the bulk of the systems envisioned.

The consumer and automotive computer markets are extremely price sensitive and do not require excessively high performance. Thus, in order to be successful in this area it is incumbent on the semiconductor manufacturers to introduce new microprocessor products which achieve a given performance level, but do so at minimum system cost. Price performance must be improved, but this should be achieved by lowering cost for a given performance level, rather than by increasing performance for a given price level!

Finally, before closing, the following observation should be made. Even though the microprocessor is the key to the development of many new low cost intelligent systems, it is the development of compatible low cost peripherals (e.g., floppy discs) and LSI memories (static 1K RAM's are approaching 0.4 cents/bit and dynamic 4K RAM's are approaching 0.3 cents/bit at the chip level) that is making this system revolution possible. Recent developments such as the modem-on-a-chip (Motorola MC6860), point to the availability of a large variety of standard LSI microprocessor interface, which can only help to accelerate this revolution.

REFERENCES