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This paper outlines a program for the development of a computerized information network at the University of Kentucky. The Agricultural Network System for Education and Research is an information system to be used both for the delivery of computerized decision aids and for data retrieval systems. Unlike some computerized information systems, ANSER is not geared to serve the needs of only a few special interest groups. The system is designed to meet the needs of a diversified clientele including farmers, county agents, rural development specialists, agribusinessmen, local power figures and other decision-makers. These clientele share a common need for up-to-date information and assistance in making good decisions. The scope of ANSER is broadbased and comprehensive. Extensive planning has been done to ensure that the system has appeal to the diverse clientele of agricultural economics.[1]

Design Philosophy

The development of foolproof software for use by clientele is the major problem in the design of a computer network (4). Researchers in agricultural economics develop computer software for dealing with problems in conjunction with research. However, much of this software is

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[1]See also the systems outlined in (5,6,7,9).

ill-suited for use by extension clientele. Even though the problem that the software solves may be relevant to an extension audience, computer input and output may be incomprehensible. Candler argues that the software needs of extension are more demanding than the corresponding needs for research, and this explains the slow adoption of computer technology in the extension field (1).

Kentucky's ANSER network is designed to make full use of existing software. While some software is explicitly being designed for the ANSER network, work is also taking place in designing input and output for existing research models to make them useful to extension clientele. The use of existing software in conjunction with the ANSER network has necessitated a choice of hardware with a high degree of flexibility. Three examples are used to illustrate the integration of hardware choices and software development.

Examples of Software Components

The Beef Simulator

The agricultural economics department, in conjunction with the departments of agricultural engineering, agronomy and animal sciences have developed a large scale simulation model of the beef-feed enterprises of a livestock farm in the southeast (10,11). The model simulates the growth of both plants and beef animals, energy requirements, cash flow, and net worth in a dynamic setting. Detailed descriptions of a farmer's land, labor, machinery, feed, money, resources, sources of credit, and other information are needed for model operation. Alternative management strategies for beef cattle production are also specified by the farmer. Output consists of 40 pages of computer

printout, and provides the farmer with detailed information with regard to the effects of alternative management strategies on the profitability of the beef enterprise.

KASH PROFITS

The KASH PROFITS program uses a linear programming model consisting of 116 rows and 185 columns (3,4). The output is designed to aid commercial corn-soybean farmers in planning cropping patterns, making machinery aquisitions, and in timing of planting and harvest operations. Farmer input is achieved by completion of an input form. Detailed information with regard to the availability of land, labor and machinery, expected crop yields and prices and other information is required.

The DISK System

The Development Information System for Kentucky (DISK) is a joint project sponsored by the department of agricultural economics and the department of rural sociology (8). The initial component of DISK is the development of a computerized retrieval system for socioeconomic data. Data for each Kentucky county on population, incomes, employment, and other social indicators are included in a format suitable for use by local decisionmakers. While initial emphasis has been placed on building a data retrieval system, an analysis component is also being developed. Seven graduate students are currently working on research projects that will generate models to eventually become part of the analysis component. These models are designed to simulate and predict county level agricultural production commodity-by-commodity, taxation and revenue, employment, population and transportation. Each is being designed for use in a problem solving setting. Users will be public or private

decisionmakers who have access to a computer terminal. Most will make use of data stored within the data retrieval component of DISK. Potential clients of the DISK system include county agents, public officials such as mayors and county judges, development administrators and planners, and other local citizens.

Hardware Requirements

Each project places special requirements on the hardware configuration for ANSER. The Beef simulation model uses a large amount of core, making access to a major CPU essential. The quantity of input and output required by the model makes a conventional remote terminal impractical for user access. Because of the size of the output, high speed line printing is necessary.

The KASH PROFITS program also uses a substantial amount of core. In addition, access to a linear programming solver such as MPS 360 at the host computer is required. The KASH PROFITS program differs from the beef simulation model in that a smaller quantity of input is required. The output of the KASH PROFITS program consists of 654 lines. Hence, the KASH PROFITS program could be accessed at a remote terminals operating at 180 characters per second. However, if used in a workshop with 40 to 50 participating farmers, a high speed line printer is required.

The information retrieval component of DISK is designed for access through a conventional remote terminal operating at low speeds (30 characters per second). Most information retrievals result in tables consisting of less than 100 lines of information. Problem solving simulators will produce output of 100 lines or less. A highly portable

terminal is ideal for access to DISK. A portable terminal also makes easy access possible for the variety of potential clients of the DISK system.

Systems Design

The selection of hardware components of ANSER is consistent with the requirements of software development efforts. The system consists of three major components: a host computer consisting of the current IBM 370-165 CPU at the University of Kentucky, minicomputers located at Lexington and at 2 regional centers, and remote terminals at county agents' offices. Associated with each minicomputer will be card reading and line printing capability at 600 lines per minute. Leased lines will connect the host IBM 370-165 with the minicomputers and the remote terminals. Figure 1 illustrates the concept for the host computer located at Lexington, Kentucky, and one of the regional centers approximately 225 miles away from Lexington.

The host computer will serve as the batch processing unit for large models being used in the ANSER system. Linked to the host computer at Lexington will be a minicomputer in the agricultural college. This minicomputer will enable the host computer to be used interactively, and will preprocess input prior to processing by the host CPU, as well as do the complete processing of smaller programs. Card reading and line printing capabilities were selected to meet the needs of researchers in the agricultural college as well as extension personnel who wish to work with computerized decision models (such as KASH PROFITS or the beef cattle simulator) on campus. Sufficient disk storage space for the DISK project and other information systems that feature data retrieval will be located at Lexington and linked to the minicomputer.

Regional centers will be linked to the Lexington campus via a leased line. Minicomputers will serve as a multiplexor so that multiple signals can simultaneously pass through the leased line. Card reading and line printing capabilities equal to those available on the Lexington campus will be available at each regional center. This will enable agricultural economists to hold workshops using batch oriented computerized decision models with 40 to 50 farmers in the western part of the state. Remote computer terminals to be located in county agents offices will be wired into the minicomputer closest to their office.

County agents will be free to choose the type of computer terminal best suited to the software being accessed in the system. County agents located in the large commercial grain producing areas will probably choose a non-portable terminal capable of printing 132 characters per line and operating at 180 characters per second. These are the requirements if KASH PROFITS software is to be accessed at the county agents' offices. Other counties who may select a portable terminal capable of printing only 80 characters per line and operating at 30 characters per second. These parameters are compatible with the DISK software. Some counties may elect to purchase both a stationary and a portable terminal.

Computer programmers are employed for developing much of the input and output as seen by extension clientele. This work does not proceed without a complementary coordinated effort by state extension specialists within agricultural economics and other departments of the agricultural college. The state extension specialist can best judge the suitability of a specific input and output design for his particular clientele.

Moreover, the specialist who uses the software as part of an extension program must bear ultimate responsibility for the accuracy of the software.

Training of Clientele Groups

A major effort in the ANSER program is being devoted to the design of training facilities or county agents, community leaders and other interested clientele groups. This effort has culminated in the building of the visual data center.

The visual data center is planned to serve two needs. (1) It will serve as a workshop center for efficient training of 40 to 50 persons on the use of computer software available through ANSER, and (2) it will be the center for working with farmers and others who are using models such as the beef cattle simulator and KASH PROFITS. A visual data center is currently being built at the agricultural college on the Lexington campus. Plans call for a visual data center to be located at the other regional centers.

Figure 2 illustrates the visual data center. The major equipment in the visual data center is a large screen television set suitable for viewing by 40 to 50 persons. This television is wired to a computer terminal that outputs to a video signal. The terminal is linked to the minicomputer and the host computer. Lines also connect portable terminals located on countertop space near each seat. The arrangement enables the instructor to display on the large screen television procedures to be used in accessing the computer. County agents, students, farmers or others in the room will immediately be able to follow the same procedure using the terminal located directly in front of them. Incorrect responses by those in the room will become immediately apparent,

since the output generated on the terminal can be easily compared with that on the large screen television. This will provide for very efficient instruction of large groups on proper terminal operating procedures.

The room is also designed as an instructional area enable the use of conventional video-tape technology. Video tapes may include instructional aids designed to teach FORTRAN programming fundamentals and keypunch operation as well as video tapes in subject matter areas not directly related to computers.

Current Status and Expected Future Developments

Figure 3 illustrates the completed system. Equipment for the Lexington campus will be in place by June 1, 1978. The first regional center is expected to be completed by April 1, 1979, with computer terminals installed in local county agents' offices surrounding both sites at this time. The system will be completed by December 31, 1979.

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Figure 1. The Host Computer and the Terminal System.

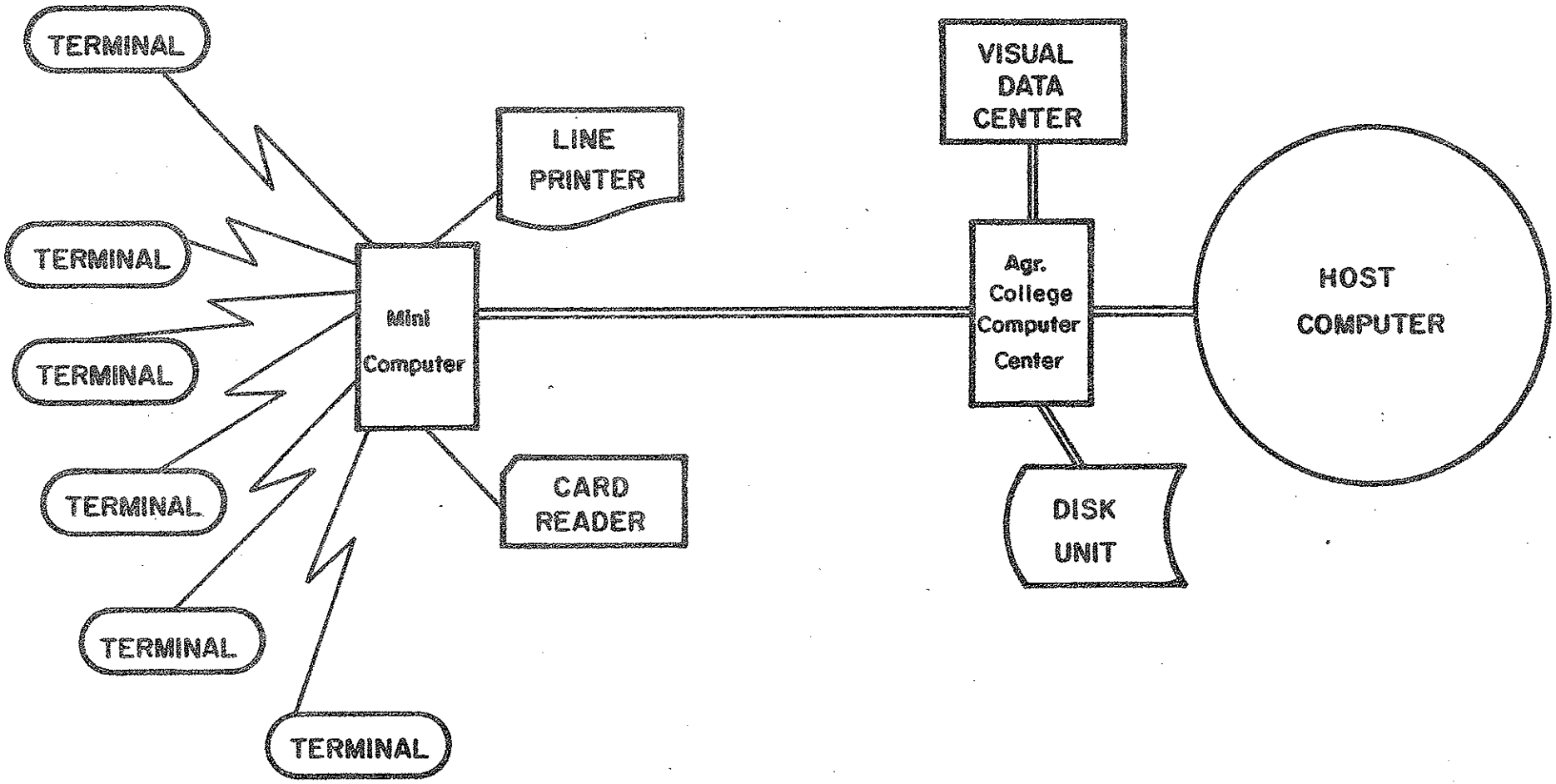

Figure 2. The Visual Data Center.

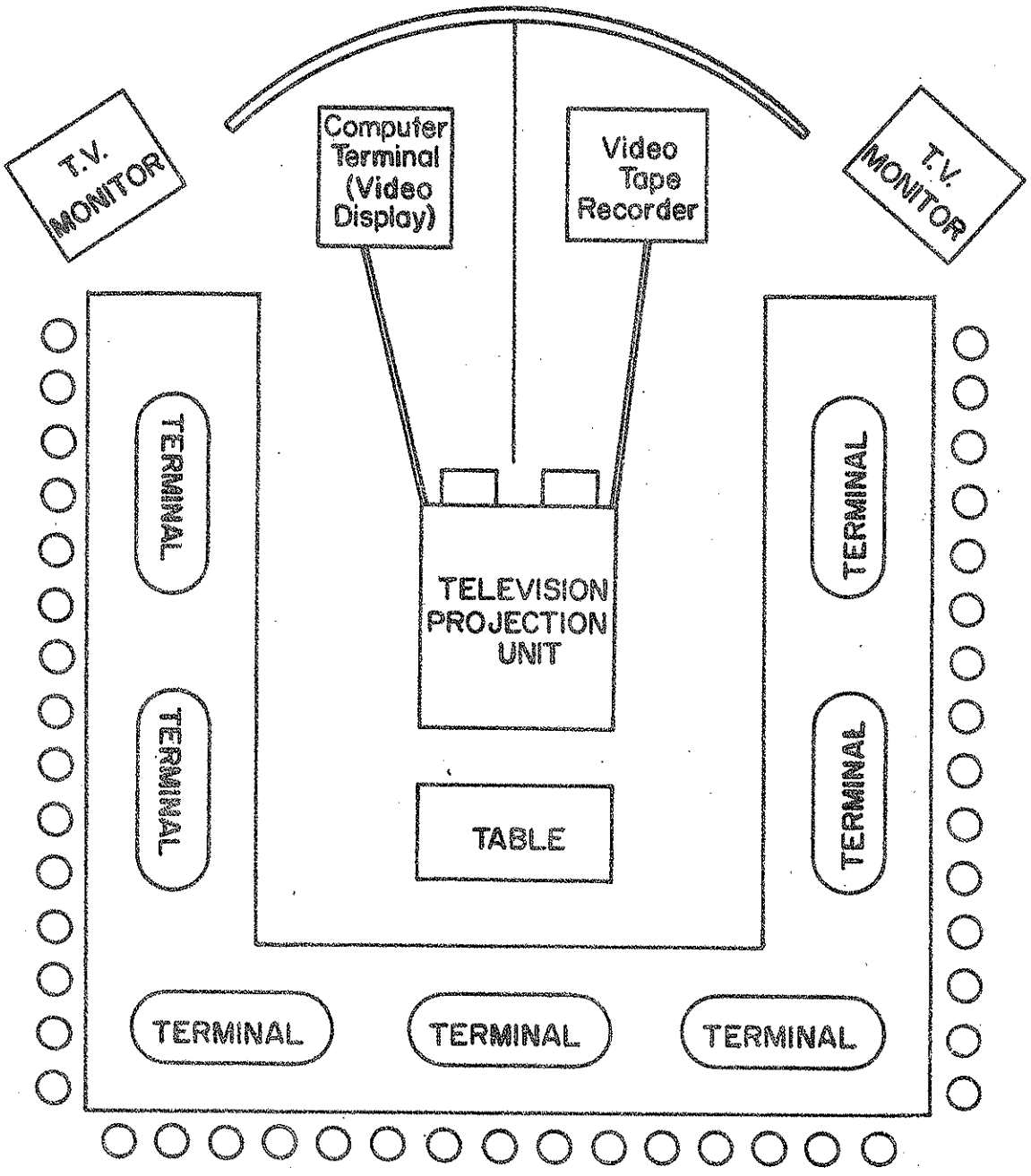

Figure 3. The Completed System.