April 25, 2007

RAMAC RESTORATION PROJECT

Hardware on loan from IBM: A "½ RAMAC" or the disk drive mechanics only.

Compressed air operates 5 solenoids to operate detenting for disk position (in and out), track (odd or even) and head load or unload on a disk Cabling on the drive to terminal blocks included wiring to the individual disk taps on a linear resistor strip for disk selection, and a rotary track detent positioning potentiometer on the moveable arm assembly. Also, a connector for pressurized air existed as the mechanical detent and the head/disk spacing functions are controlled by air solenoids.

Our initial tasks included refurbishing wiring and air hoses, cleaning the surface of each disk, selecting usable magnetic heads, inserting new pistons in the individual air head assemblies, refinishing the magnetic clutch plates and lubricating the disk drive motor bearings. Additionally an air compressor was installed and connected....

The project naturally divides into three phases of which the first two are underway.

1, Develop suitable read/write electronics to meet the recording characteristics of the RAMAC.

The approach has been to first sense and stores all the signals detected on the disk tracks before we start writing. (A project at SCU checked and verified that we could modify stored data by developing a write circuit to verify using just one record address.) To read data on the disks an operational actuator is not needed. For this phase we need only spin the disk stack, load and unload the head on each disk, and sense and store the recorded signals. The head/arm is manually positioned to obtain the "on-track" signals (peak amplitude) signal for each track we read. On the top of the disk stack is a rotating magnet and 5 fixed pickup heads to give us rotational positional information for each of 5 records on a track.

We have shown we can read and decode data on the disks that was written 50 years ago. Attached is a current status report on this effort. Interest in our results has led to the planning of a paper on this study for presentation next year. The lead engineer here is Joe Feng.

2. Design of a servo control system to position the head/arm assembly to the selected disk and track detent positions.

For this effort it is not necessary that the disk spin or the head be loaded or unloaded. At SCU we started such an effort using a digital microprocessor approach. A low speed unit was designed with limited access speed that proved the feasibility of head positioning.

On transfer to CHM the new leader of this effort, Dick Oswald, chose to implement an analog servo system, a transistorized but otherwise similar design to the one on the original RAMAC. He felt this was the most direct approach to demonstrate access performance similar to the original RAMAC. The rotary track positioning potentiometer on our unit had one missing contact point and recently a swap of this unit was agreed upon with the one on the RAMAC that Hitachi now owns.

The servo hardware is designed and is now being constructed off site and when ready will be brought to the laboratory for testing. This timing of these two phases turns out to be an advantage by allowing the acceleration of the recording electronics phase of activity, since the actuator and read/write activities each require the somewhat exclusive use of the disk drive.

3. <u>The design of the computer-based system with associated software to provide flexible program control and suitable safety features has yet to be started.</u>

   This effort will involve another set of skills and initiated when the first two phases clarify the features needed. In terms of performance modes, safety features, etc.

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