Integrated Voice Recognition and Picture Archiving and Communication System: Development and Early Experience

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Voice recognition (VR) and picture archiving and communication system (PACS) both have advantages and disadvantages in radiologic practice. We describe a fully integrated VR/PACS system running on a single platform. Integration optimizes the positive features of both systems and creates a synergy that is not otherwise realized. The planning and development of the system is described, as well as a number of challenges that were addressed. Radiologists have viewed the process changes very positively during initial use.

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VOICE RECOGNITION (VR) for radiology has recently been receiving increased attention as hospital systems focus on potential cost savings. Several studies have demonstrated significant decreases in transcription costs, as well as markedly improved turnaround times.^{1,2} Some reports have expressed frustration with the system for a number of reasons, often related to inconvenience to the radiologist.³ One report specifically cited bar coding as a source of difficulty.⁴ It has been suggested that the interfacing of VR with a picture archiving and communication system (PACS) would remove many of the practical impediments to its widespread acceptance.⁵

We describe a system in which the VR software is interfaced and embedded directly into the PACS. Our objective was to streamline workflow for the radiologist and simplify the necessary but unproductive tasks performed during image review and dictation. The integration has resulted in decreased distraction to the radiologist and increased acceptance of both systems within our department.

MATERIALS AND METHODS

We installed a stand-alone VR system (Talk Technology, Bensalem, PA) in December 1998. Since then, all reports within the department have been dictated using the system and no human transcription is utilized. The VR system is interfaced with the radiology information system (RIS) with transfer of demographic data from the RIS to the VR and transfer of electronically transcribed text back to the RIS. PACS with computed radiography (General Electric Medical Systems, Milwaukee WI) was installed in January 2000. The department is filmless with the exception of mammography. The two systems ran independently until May when integration was achieved.

The integration structure was planned during on site visits by software engineers from both companies. The main objective was to decrease as much as possible the navigational tasks

performed by the radiologist. We asked that there be a single log-on/log-off feature. We required that the VR screen not interfere with image viewing. A single command would open the images as well as the dictation screen and there would be a single command to sign off the report, close the case, and open the next set of images with the appropriate dictation screen. In addition, we required a failover strategy when any one of the systems, as well as the network or RIS was not functioning.

RESULTS

The integrated system is demonstrated in the workflow diagram (Fig 1). After the user logs on, both the PACS and VR are activated. The radiologist views a PACS work list and selects "dictation macro" command by mouse click on the PACS screen. The images are displayed. A message is sent from PACS to VR to open the appropriate dictation screen for that patient. The dictation screen can be configured to display any demographics received from the RIS. The radiologist controls the dictation screen, which can be moved, anchored, resized and toggled in front of or in back of the images by a single microphone button command. To accommodate different work habits, multiple choices for viewing or hiding the screen during dictation or after dictation can be configured in the user preferences.

After the images are reviewed and the report is dictated, a single "sign report" command is executed using either mouse click, voice command, keyboard macro, or microphone button. This command marks the report status as "signed" in the VR system. The text is sent to the RIS database where it is faxed to the appropriate clinician office or hospital department. The text is also sent by the RIS to the PACS database. This process takes approximately 50 seconds. Once this is achieved the report status is changed to "signed" within PACS.

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In current use, slow downs can still occur if the microphone or soundcard quality is marginal or the manual cine feature of the PACS is used to scroll through images at the same time dictation is being performed. This appears to overwhelm the central processor. Dual -processor hardware is being considered to improve this application. In the meantime these problems are easily avoided as long as the radiologist is aware of them. There is still an occasional network error that requires logging off and on. We are currently unsure of the exact cause.

DISCUSSION

The initial acceptance by the radiologists of both VR and PACS in our department was good. We had used VR approximately 1 year before installing PACS. The PACS was in use 6 months before we integrated the two systems. The learning curve for speech recognition is variable but is an important factor to take into account. Training and development of proficiency in this relatively new technology are critical to the success of implementation.⁷ The use of PACS required separate and distinct training as well, and the integrated system required a third although shorter length of time for the radiologists to become comfortable and learn the new features. There may be difficulty incorporating all of these features into a department simultaneously. It would likely be beneficial to become familiar with one of these systems initially and then integrate with the other.

Process improvements of an integrated image

viewing and dictation system have been described in the limited area of chest radiography.⁶ The advantages of a fully integrated PACS and VR system are numerous. One keyboard and mouse controls the entire electronic desktop. No manual entry of patient data is necessary. This virtually eliminates the possibility of data entry error. No barcoding is required. This has eliminated the need for any type of paper request form within our reading room. The integration has eliminated many manual and navigational tasks previously performed by the radiologist, allowing greater concentration on image interpretation. In the future, structured reporting will be facilitated by the increased ease of linking image to text. The selected image need only be dragged to the appropriate phrase or paragraph to create a link.

CONCLUSION

The advantages of VR include marked improvement in report turnaround time and cost savings for the department because of decreased transcription costs.⁷ The main disadvantage is a perceived burden to the radiologist in performing editing and multiple navigational tasks. PACS has been shown to increase radiologist efficiency,⁸ but its cost effectiveness has been debated.^{9,10} We feel that the combination of VR and PACS in a fully integrated single platform has created a tremendous synergy, with process improvements that maximize the advantages of both systems.

REFERENCES

1. Mehta A, Dreyer KJ, Schweitzer A, et al: Voice recognition—An emerging necessity within radiology: Experiences of the Massachusetts General Hospital. *J Digit Imaging* 11:20-23, 1998 (suppl 2)
2. Wheeler SW, Cassimus GC: Selecting and implementing a voice recognition system. *Radiol Manage* 21:37-42, 1999
3. Houston JD, Rupp FW: Experience with implementation of a radiology speech recognition system. *J Digit Imaging* 13:124-128, 2000 (suppl 1)
4. Lemme PJ, Morin RL: The implementation of speech recognition in an electronic clinical practice. *J Digit Imaging* 13:153-154, 2000 (suppl 1)
5. Kanal KM, Hangiandreou NJ, Sykes AJ, et al: Evaluation of the accuracy of a continuous speech recognition software system in radiology. *J Digit Imaging* 13:211-212, 2000 (suppl 1)
6. Pavlicek W, Muhm JR, Collins JM, et al: Quality-of-service improvements from coupling a digital chest unit with integrated speech recognition, information, and picture archiving and communications systems. *J Digit Imaging* 12:191-197, 1999
7. Antiles S, Couris J, Schweitzer A, et al: Project planning, training, measurement and sustainment: The successful implementation of voice recognition. *Radiol Manage* Jan/Feb:18-36, 2000
8. Redfern RO, Horri SC, Feingold E, et al: Radiology workflow and patient volume: Effect of picture archiving and communications systems on technologists and radiologists. *J Digit Imaging* 13:97-100, 2000 (suppl 1)
9. Pratt HM, Langlotz CP, Feingold ER, et al: Incremental cost of department-wide implementation of a picture archiving and communications system and computed radiography. *Radiology* 206:245-252, 1998
10. Duerinckx AJ, Grant EG: Cost of PACS and computed radiography in the United States. *Radiology* 208:554-556, 1998 (letter)