

Improvements to the Voice Recognition-Based Operation Function, SMART Voice

Medical Systems Division, Shimadzu Corporation

Fumiaki Tanaka

1. Introduction

Last year, in 2024, we released “SMART Voice,” a voice control function for the Trinias series with SCORE Opera angiography system, with the aim of reducing the operational burden on healthcare professionals and improving workflow. This system can serve as a new interface that supports busy clinical settings by enabling device operation through voice even when physicians cannot use their hands, and by providing voice recognition functionality with high responsiveness. We have now further improved SMART Voice, and in this article we introduce the new functions.

2. Background to the Improvements in SMART Voice

The SMART Voice released in December 2024 focused on responsiveness from speech input to system action, and its development was limited to the operation of major functions. The objective was to provide a clear answer, in actual clinical practice, to the question: “Can voice recognition be used in an angiography system?” In developing this function, we considered specific use scenarios for voice recognition in medical settings while obtaining feedback from physicians and clinical staff at the clinical site.

When SMART Voice was actually used in clinical practice, it received many positive evaluations from various medical facilities in Japan and foreign countries. In addition to the advantages of voice recognition—namely, that physicians could perform operations by voice alone instead of verbally instructing surrounding staff, and that operation remained possible even when both hands were occupied—its responsiveness in voice recognition and voice operation was also highly praised.

Furthermore, we received comments such as “stress-free and intuitive to use” and “even in emergencies when technologists are busy or unfamiliar with the procedure, physicians can perform the intervention with confidence,” which gave us a strong sense that the voice control function is useful as a new user interface for angiography systems.

On the other hand, feedback from users and from exhibitions and congress made it clear that there was a strong demand for expansion to a broader range of functions and for greater flexibility suited to actual clinical workflows. To address these new needs, we added new functions to SMART Voice.

3. Newly Added Functions

3.1 Concept of the Improvements

In recent years, amid social challenges such as workstyle reform and shortages of medical personnel, the clinical environment has been changing rapidly. As the number of staff involved in procedures decreases, the number of devices that a single clinical staff member must operate tends to increase. As a result, a recurring issue, especially in emergency examinations and situations requiring sudden response, is the lack of staff familiar with operating the angiography system.

Feedback and requests received after the release of SMART Voice also indicated that such concerns and expectations were present at the core of the issue. With the goal of enabling anyone to use the system easily and quickly, we adopted “reducing the learning burden required to operate the angiography system” as the concept for improvement, and added two functions: 1) support for C-arm position changes, and 2) support for a variety of ways of “saying” commands.

3.2 Support for C-arm Position Changes

The function for changing the C-arm position is used in every examination, but because it is used less frequently than functions used during procedures, it tends not to be placed in the “Custom Tab,” which collects frequently used buttons on the panel console.

For this reason, changing the C-arm position required pressing a button located several layers deep in the touch panel console, and in some cases inexperienced operators were seen searching for the correct button. We believed that replacing this with SMART Voice would reduce the learning burden and make the function easier to use, and therefore added it.

The C-arm in an angiography system is required to assume various positions depending on the patient's imaging region and the procedure being performed. Specifically, these include the “Park position” for patient entry and exit, the “Home position” for cardiac and head procedures, and the “Multi position” and “Peripheral position” for puncture and lower-limb procedures.

This system includes both a “single-plane system,” consisting of one C-arm, and a “biplane system,” consisting of two C-arms capable of simultaneous imaging from frontal and lateral directions. In the biplane system, depending on the procedural situation, it is possible to switch between two C-arm settings: a single setting, in which only the frontal C-arm is used, and a bi-setting, in which the frontal and lateral C-arms are combined (Fig. 1).

In the biplane system, there are 14 C-arm positions in total, including those for the single setting and bi-setting, and the user selects the most appropriate position for the procedure.

Although C-arm position changes are not a function used frequently during an examination, they are used every time an examination is performed. Therefore, making this operation simple and smooth contributes to improved workflow in the clinical setting.

With this new function, the C-arm position can now be specified easily by voice control, and the position change is completed by subsequently pressing the SET button provided on the operation console. This reduces the need to search for and press the button corresponding to the desired position, allowing the system position to be specified immediately without taking one's eyes or attention away from the monitor, thereby helping to ensure seamless procedural progress.

Figure 2 shows the commands added to SMART Voice for C-arm position changes. The details of the commands are as follows:

- “Park”: the C-arm retraction position used during patient transfer and after completion of the examination
- “(Frontal/Bi) Home”: the position mainly used for cardiac and head procedures
- “(Frontal/Bi) Multi”: the position used for puncture and arm/lower-limb procedures
- “(Frontal) Side”: the position used, for example, when performing SCORE CT imaging (cone-beam CT imaging) with the C-arm inserted laterally in the abdomen
- “(Frontal/Bi) Peripheral”: the position for procedures involving the lower leg or foot

C-arm position operation with SMART Voice, like other SMART Voice commands, becomes available by speaking the wake word “Trinias,” after which the system enters command reception mode.

While the “Listening” icon is displayed on the Live screen, speaking “Home,” “Side,” or “Peripheral” sets the recognized C-arm position as the next position, and the C-arm enters position-change operation mode.

When a command is recognized, the position name is displayed in the SMART Voice response indicator, and at the same time the name of the destination C-arm position blinks in the system information display (Fig. 3). In this state, keeping the SET button pressed on the operation console

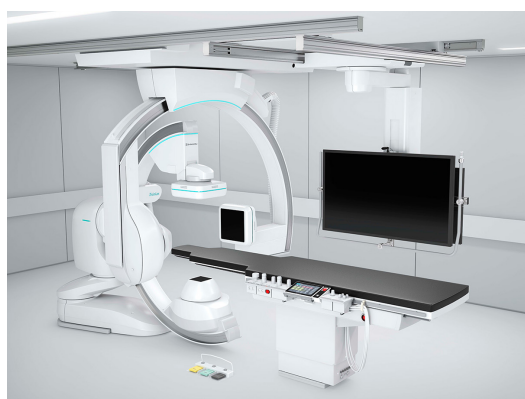
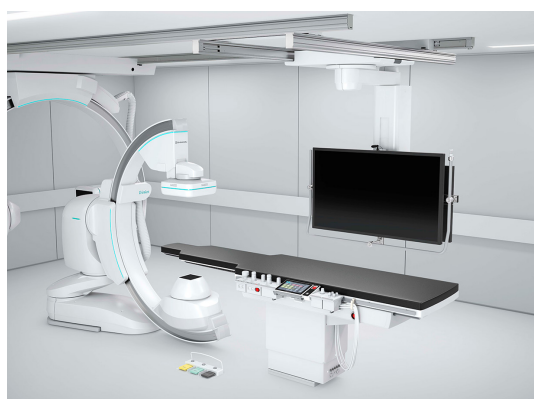


Fig. 1 C-arm settings: single setting (left) and bi-setting (right)

initiates the positioning movement, and the display in the information area remains until the movement is completed or the positioning function is canceled. This allows staff other than the operator to confirm that the C-arm is in motion mode.

In the case of a biplane system, by adding the keywords “Frontal” or “Bi” before position names such as “Home” or “Multi,” the user can directly specify a position while switching between bi-setting and single-setting.

For example, when the C-arm is currently in the multi position under the single setting, speaking “Home” issues an instruction to move to the home position while remaining in the single setting; however, speaking “Bi-Home” directly instructs a change to the home position in the bi-setting, combined with the lateral C-arm (Fig. 4).

By enabling both position changes that maintain the current C-arm setting and operations that include switching the C-arm setting, we have made it possible to perform the complex position selection required in biplane systems using simple voice commands.

3.3 Support for a Variety of “Ways of Saying” Commands

Another major improvement is support for a variety of “ways of saying” commands.

Until now, SMART Voice required users to speak the command name correctly, and each command name had to be memorized individually.

In addition, in clinical practice, even when referring to the same function, the wording used may differ depending on the department or region. For this reason, we asked medical facilities using SMART Voice and attendees at exhibitions and congress about expressions that might actually be used in clinical settings. As a result, for example, regarding the fluoroscopic save function, we learned that different institutions use different expressions such as “Store” and “Record” in addition to “Save.”

Memorizing and speaking unfamiliar words can be a psychological burden, especially in the busy clinical environment. Therefore, in this improvement, we expanded the range of expressions that can be recognized by allowing multiple command names for a single function, and by bringing the supported

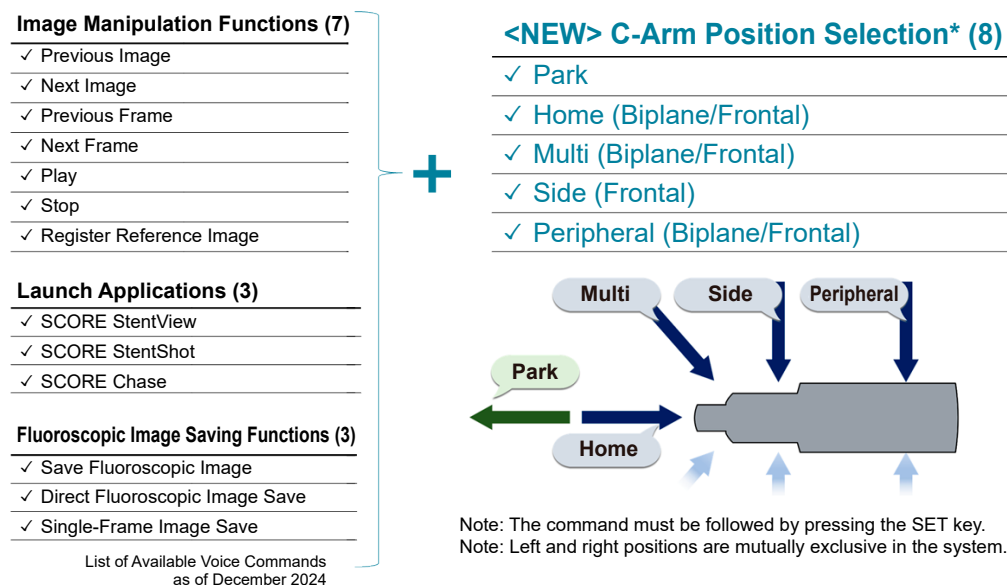


Fig. 2 Commands added for C-arm position operation

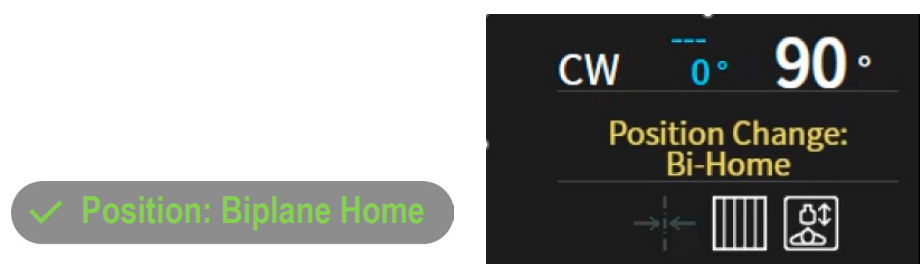


Fig. 3 SMART Voice response indicator (left) and the indicator for the C-arm position operation command displayed in the system information area (right)

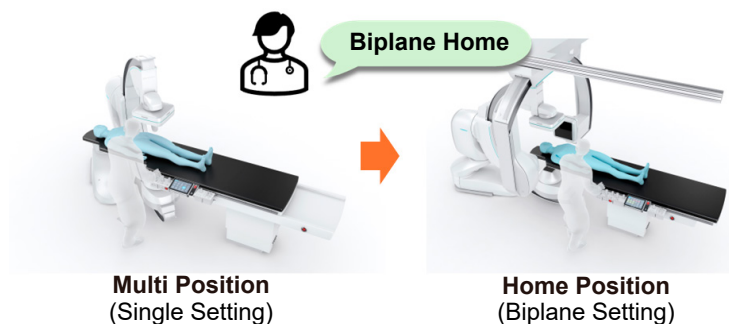


Fig. 4 Position switching while changing the C-arm setting

Function	Primary Command	Additional Expressions
Stop Animation	"Stop"	"Pause", "Animation Stop"
Save Fluoroscopic Image	"Save"	"Record", "Store", "Save Fluoroscopic Image"

Fig. 5 Examples of the newly added command expressions

expressions closer to the natural wording actually used in clinical practice, with the aim of making voice recognition easier to use (Fig. 5).

By broadening the range of command recognition, SMART Voice can now recognize natural expressions that are commonly used in daily practice. We believe that this lowers the psychological barrier of having to memorize fixed phrases and represents a step toward making voice control more familiar to a wider range of users.

4. Conclusion

Since the release of SMART Voice, we have received considerable interest from many users, as well as numerous constructive suggestions from clinical practice. In this update, with the concept of “reducing the learning burden required to operate

the angiography system,” we have implemented the long-requested addition of C-arm functions and expanded command expressions. With these improvements, SMART Voice can now be used in a broader range of medical institutions and clinical situations.

We will continue to develop the system based on user requests, further improving usability, including voice control functions, and providing the latest treatment environment through the framework of SCORE Link, our application platform for subscription-based services. We hope that these latest technologies will help reduce the burden on healthcare professionals and improve workflow.

Trinias and SCORE are trademarks of Shimadzu Corporation or its affiliates in Japan and other countries.
SCORE is an abbreviation of Shimadzu Challenge Of Revolution. SMART is an abbreviation of Shimadzu Makes Advanced Remarkable Technology.