

Bradley University
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GuideBot
System Block Diagram

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Overview

The objective of this project is to develop an autonomous interactive robot guide. The robot, designated GuideBot, will be made to interact with people via a touch screen display and audible greetings. GuideBot uses the Pioneer DX2 platform from the Telerobotics project of 2001. GuideBot will use proximity sensors for collision avoidance, navigation, and motion detection of possible users. Figure 1 shows the high level system block diagram.

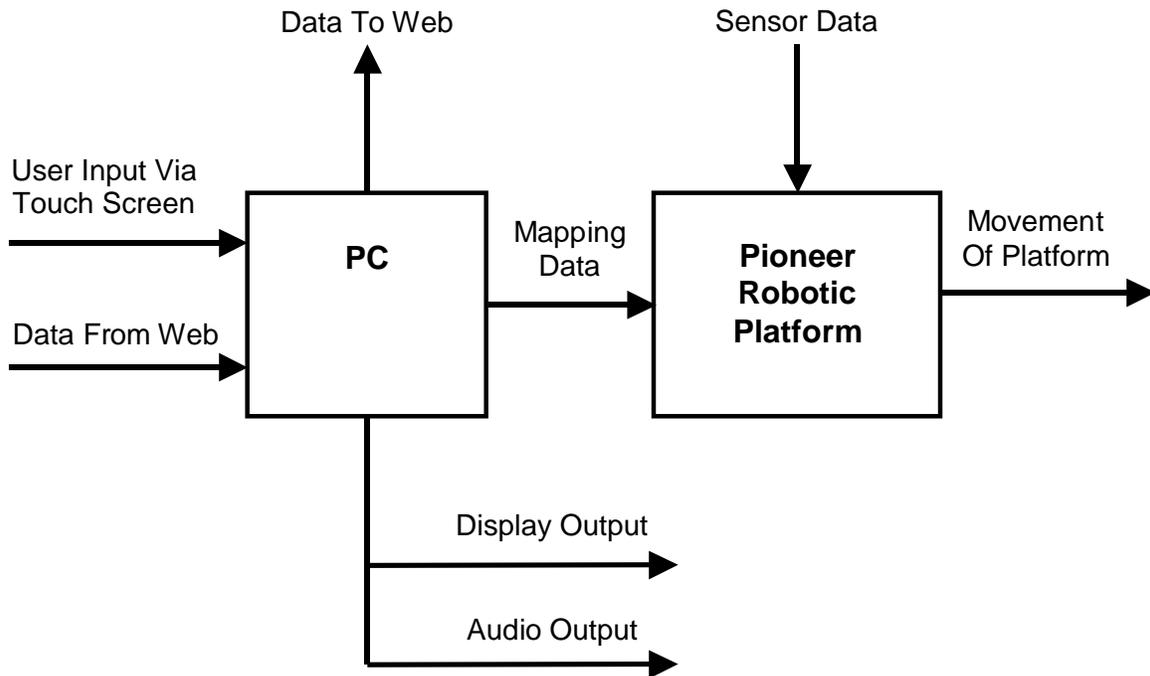


Figure 1. System Block Diagram

PC

The PC portion of GuideBot shown in Figure 2 consists of the touch screen user interface associated auditory greetings and instructions. The user is presented with a friendly Java-based menu of options including an option to have GuideBot show the user to a specific location. Once the Guide mode is engaged, the PC will communicate with the platform and determine the best way of navigating to the desired location. In addition, a Java-based web server originating from the 2001 Telerobotics project will be used as a manual control system in case the need arises to take control of GuideBot.

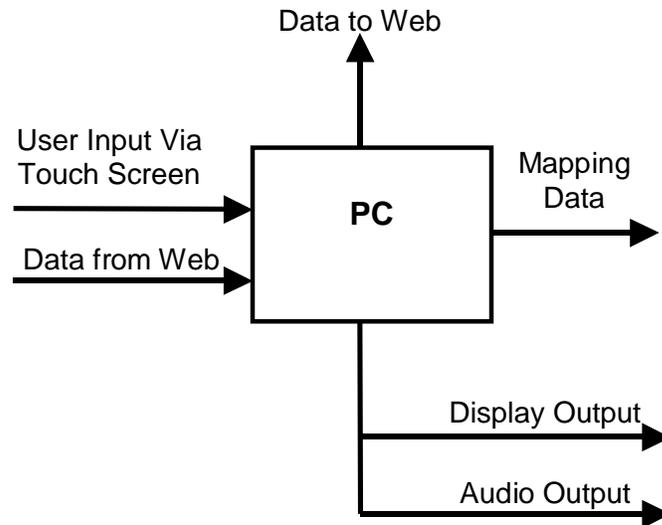


Figure 2. PC Block

Pioneer Robotic Platform

The platform is controlled by an onboard 80186 that interfaces with the multiple ultrasonic sensors and PC. The PC input includes mapping updates and the desired mode. The ultrasonic sensors positioned on the platform are used for mapping decisions and collision avoidance. The outputs include updates to the PC on GuideBot position, battery level, and possible movement hindrances. It also has control of the motors controlling the movement of the platform.

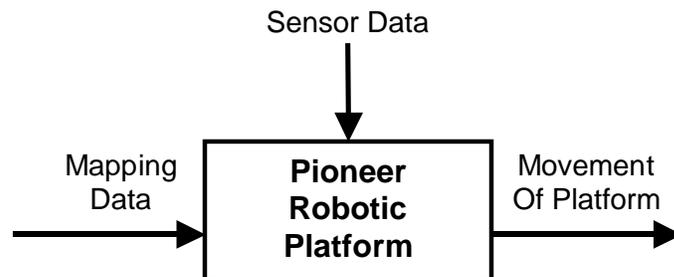


Figure 3. Pioneer Robotic Platform Block

Software Control Flowcharts

An overall software flowchart for GuideBot is shown in Figure 4. Hexagonal blocks represent actions which will update the graphical display on the touch screen and are expounded upon in more detail below. In Help/Assistance mode, the platform is idle and all interaction takes place on the touch screen.

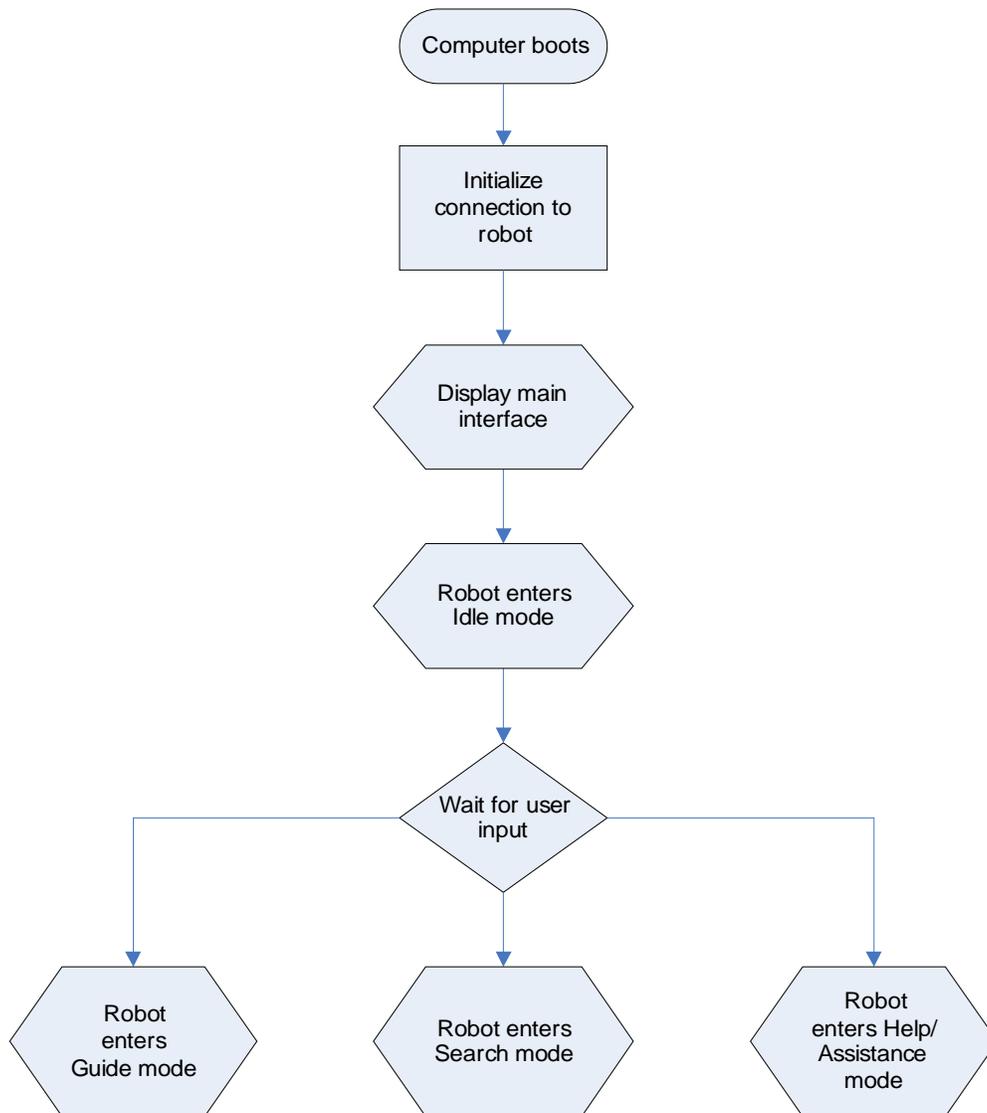


Figure 4. Overall Software Flowchart

Idle Mode

GuideBot enters Idle mode as soon as the PC boots up. Figure 5 is the flowchart for this mode. In this mode, the sonar pingers will be active searching for movement and possible users. If movement is detected, the Greeting software is activated and the system waits for contact. The sonar sensors are turned off when contact with the touchscreen occurs. If no contact, the system returns to idle/wait mode until movement is again detected.

Guide Mode

Guide mode is initiated when the guide function is selected by the user. Figure 6 is the flowchart for this mode. In this mode, GuideBot leads the user to their desired destination using a series of predetermined waypoints. This mode involves the use of the sonar sensors for both mapping and collision avoidance functions and auditory directions and warnings when necessary.

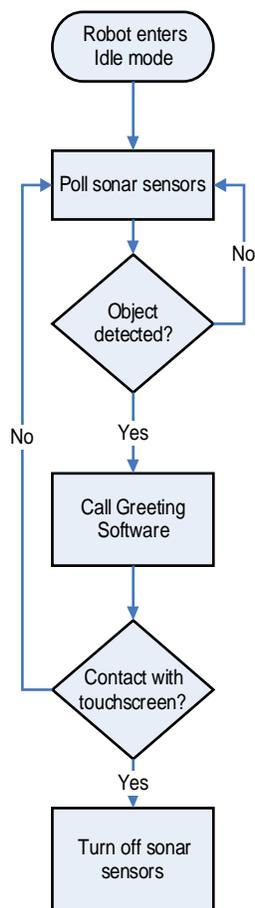


Figure 6. Idle mode flowchart

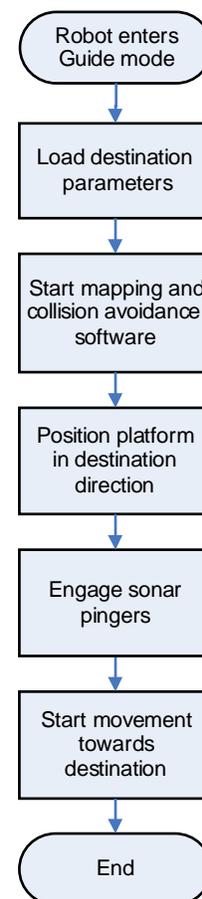


Figure 7. Guide mode flowchart

Search Mode

In Search mode GuideBot will patrol a predefined path looking for potential users. Figure 8 is the flowchart for this mode. In this mode, GuideBot relies on the sonar sensors for mapping, collision avoidance, and user detection. If movement is detected, GuideBot stops moving and activates the Greeting software. If no contact is made with the touch screen, GuideBot resumes its Search mode and continues patrolling the area.

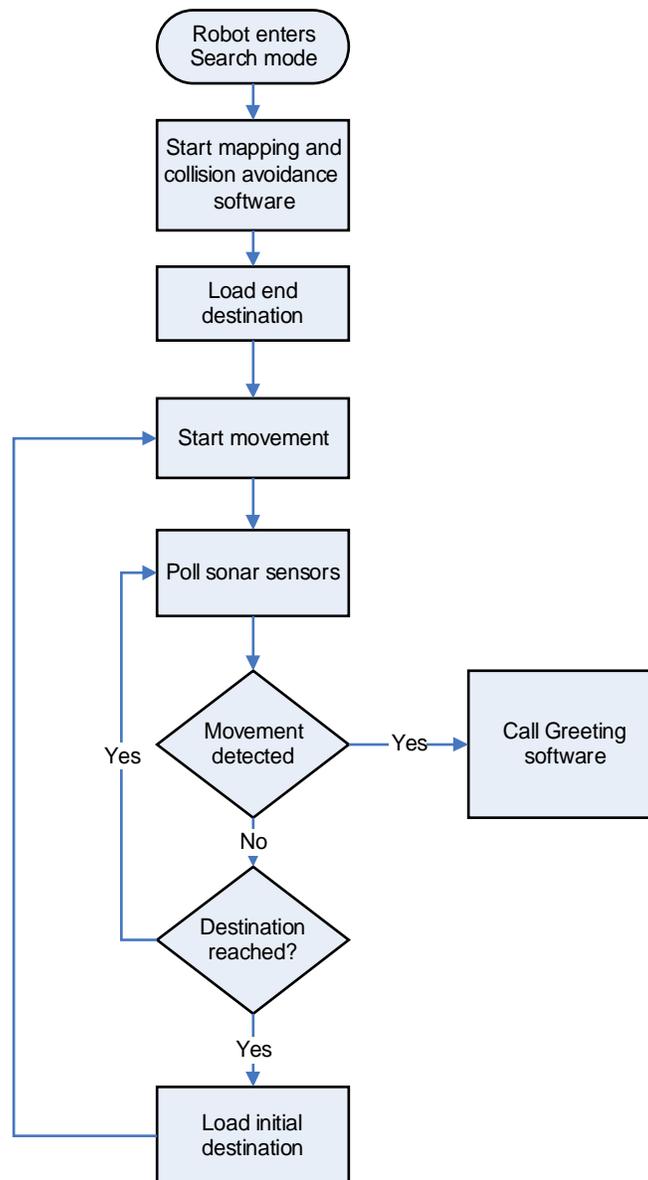


Figure 9. Search mode flowchart

Software GUI Flowcharts

The following flowcharts describe how the GUI (Graphical User Interface) changes as different modes are entered.

Main Menu

Figure 10 describes the behavior of the GUI when the system is first turned on. After the introduction video plays, the main menu is displayed for the user allowing them to choose between Guide mode or getting other information about the area (Help/Assistance mode).

Idle Mode

Idle mode is entered after no interaction occurs within a given amount of time. Figure 11 outlines the flow of the GUI in Idle mode. The screen is turned off and every so often GuideBot will call out to someone to touch the screen to get information.



Figure 10. Main Menu GUI flowchart

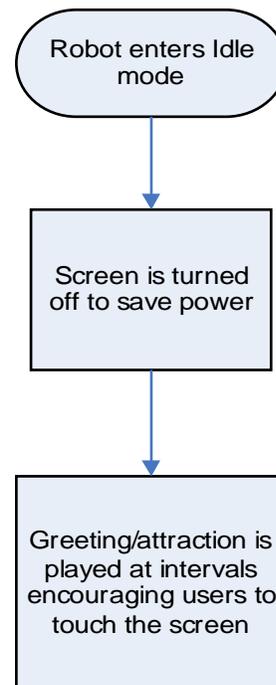


Figure 11. Idle mode GUI flowchart

Guide Mode

When GuideBot enters guide mode, the display shows a map of the area surrounding GuideBot indicating his position. It is then updated as it moves towards the specified destination as it passes pre-programmed waypoints.

Search Mode

In Search mode, a message is displayed stating that GuideBot is searching for users. Upon detecting motion, a greeting is played and the Main Menu is displayed.

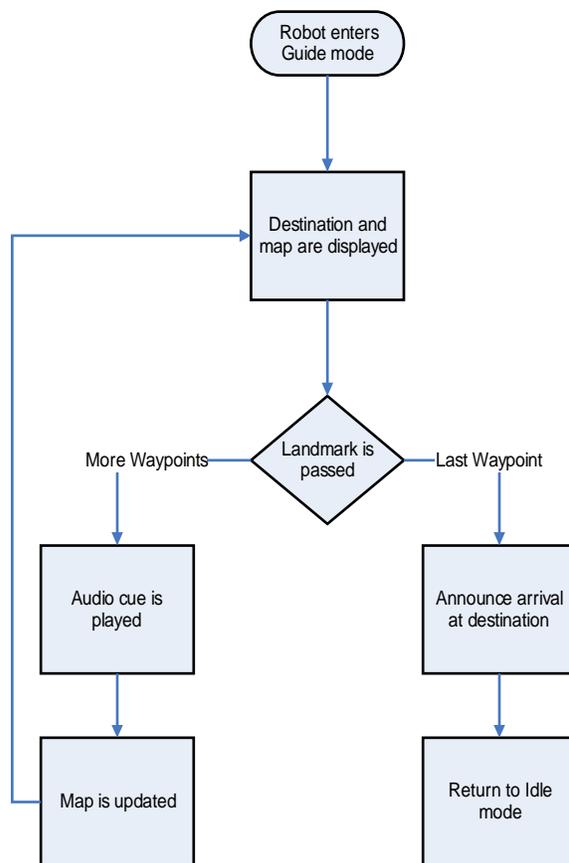


Figure 12. Guide mode GUI flowchart

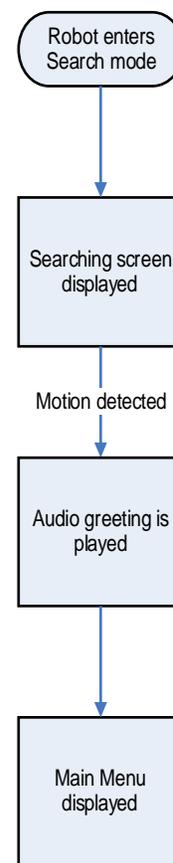


Figure 13. Search mode GUI flowchart

Help/Assistance Mode

In Help/Assistance mode, the user is presented with a menu listing the names of professors and other information. If the user touches the image of a professor, that professor's schedule is displayed as well as information about him. In addition, the user is presented with the option of being guided to the professor's office, thus engaging Guide mode.

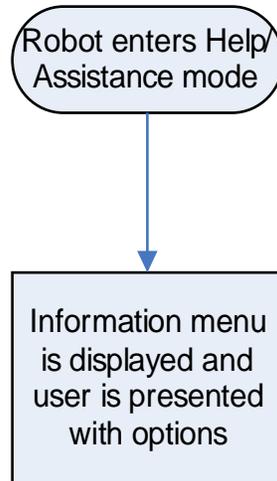


Figure 14. Help/Assistance mode GUI flowchart