

# Self-Mapping Mobile Robot (MapBot)

## SYSTEM BLOCK DIAGRAM

Submitted to

Dr. Aleksander Malinowski, Dr. Winfred Anakwa, Design Review Team

by Stephanie Luft

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### Introduction

The objective of the Self-Mapping Mobile Robot senior capstone project is to develop a robot that can independently map an area of its environment, locate itself within the map, and navigate within the environment.

### System-Level Description

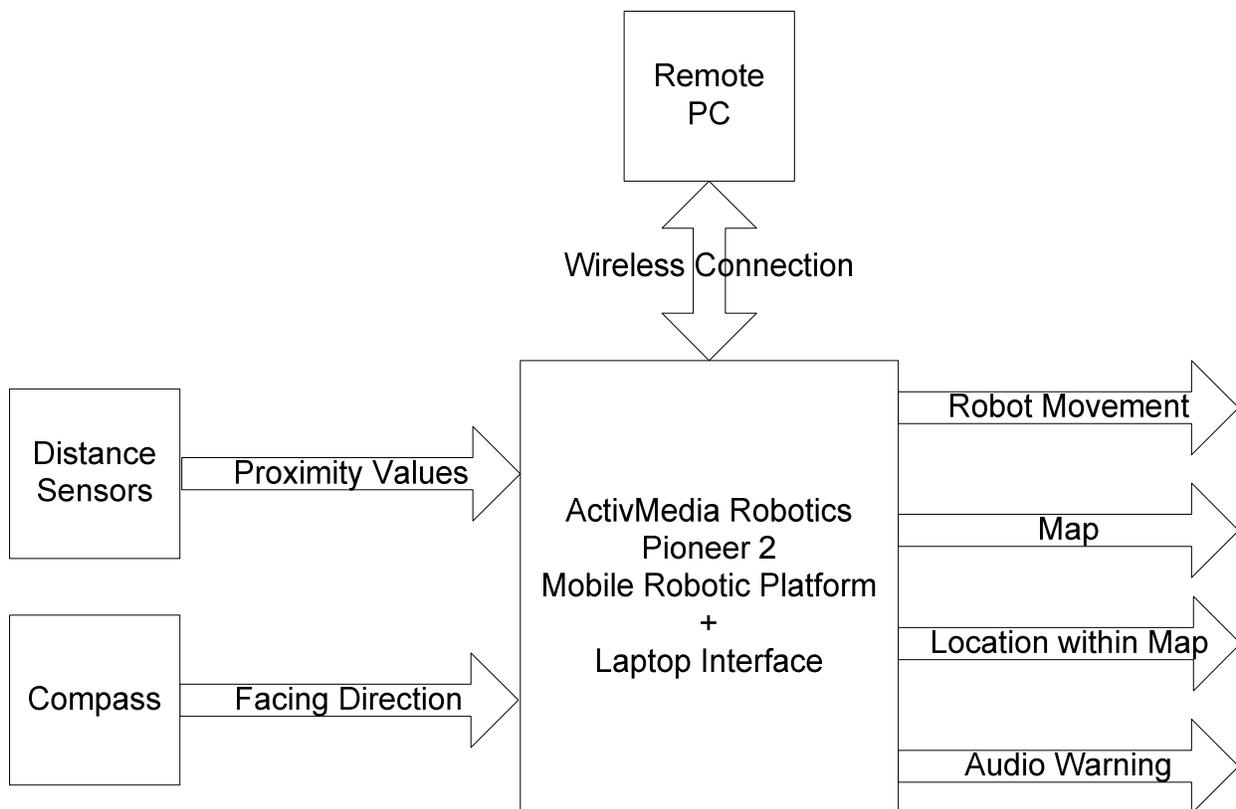


Figure 1: System block diagram for the MapBot

The primary components of the robot system, shown in Figure 1 on the previous page, will be the ActivMedia Pioneer 2 mobile robotic platform previously used in the GuideBot project and a Gateway laptop computer mounted on the mobile platform. One or more laser distance sensors will be used to measure the proximity of obstacles in the area, and a digital compass will provide directional information. A remote computer will communicate with the laptop through a wireless connection and will be used for the majority of the processing required.

The laser sensor will be mounted on a pan-tilt unit. This will allow the sensor to turn nearly 360 degrees as well as up and down. In this way, the robot will be able to detect stairs, avoid short obstacles, and look straight ahead while going down slopes.

The robot will move throughout its environment at the command of both the user at the remote computer and the “immediate response” software on the laptop. The robot will use data from the sensors and the compass to create a map of its environment and then locate itself on the map. The robot will be able to make a warning sound if it encounters a problem, for example if it finds itself in a small, closed-in space or if an obstacle approaches too quickly for the robot to avoid it.

### **Software Description**

The robot will have two main functional modes: Mapping and Maneuvering. Both modes will include obstacle avoidance features in the “immediate response” software on the laptop. The majority of the mapping and navigating processing will be done through the remote PC.

The Mapping mode will fulfill the project’s primary objective of plotting the robot’s environment and locating the robot in the map. It will include several functionalities needed to create the map, such as

- Distance sensing to read data from the distance sensor(s) and compass
- “Immediate response” obstacle avoidance, including a warning signal
- Data transmission over the wireless connection

- Plotting the map to create the visual representation of the robot's environment and showing its location
- Self-locating to determine the robot's location within the environment and within the map
- Previous map identification to allow the robot to recognize a location that it has "seen" before
- Navigation and maneuvering using semi-random motion.

The Maneuvering mode will be similar to the mapping mode in several respects, but will allow the user to direct the robot's movement. It will have many of the same functionalities, including

- Interfacing to allow the user to command the robot to map an area and to display the map to the user.
- Data transmission over the wireless connection
- "Immediate response" obstacle avoidance, including a warning signal
- Navigation and maneuvering
- Distance sensing to read data from the distance sensor(s) and compass
- Self-locating to determine the robot's location within the environment and within the map
- Plotting the robot's location on the map.

The functionality described above will be implemented using C++ on the laptop computer and using C++ and/or MATLAB with Simulink on the remote computer. The flowchart for the initial software implementation is shown in Figure 2 on the following page.

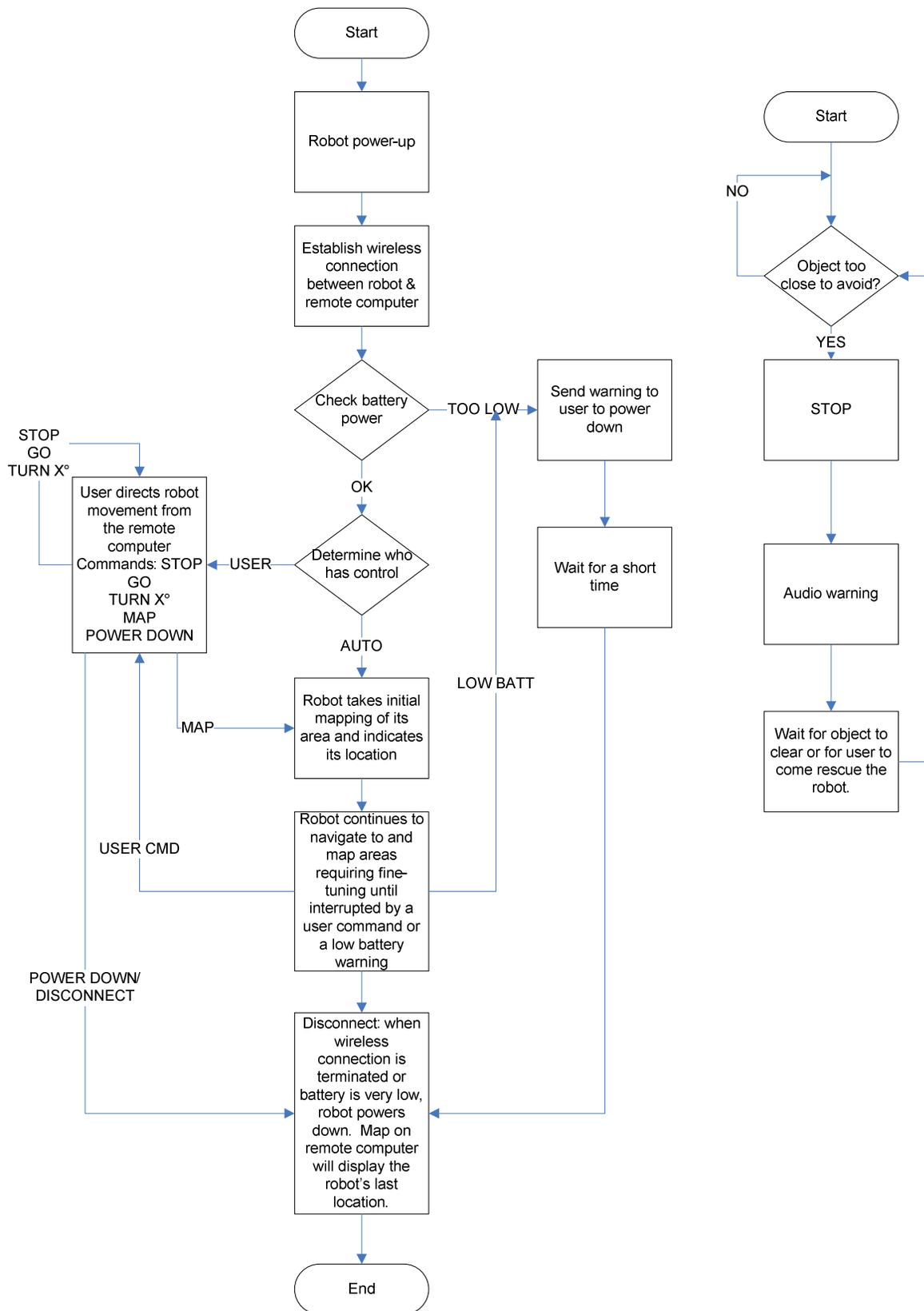


Figure 2: Initial Software Implementation Flowchart