MILESTONE 4: Functional Decomposition

Bryson Potts, Joseph Earnest, Manning Owens, Steven Harrington, Tamara McCaskill

Florida State University, Panama City

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Dr. Damion Dunlap

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<u>**Introduction**</u>

Functional decomposition is a process that involves breaking down a system's overall functions into smaller subparts. This is best achieved through team brainstorming sessions and the result is to make a diagram that illustrates how a design's general tasks and subtasks fit together. The following functional decomposition breaks down the major and minor functions of an autonomous boat.

<u>Data Acquisition</u>

The data used to generate our functional decomposition came from the RoboBoat competition requirements and the customer needs. We prioritized the system's functions around maneuverability, since a majority of the competition tasks utilize it. The interpreted needs were then simplified, so that the range of solutions were still broad. This technique prevented us from boxing ourselves into a single solution. Finally, we cross referenced the common simplified needs and turned them into our functions.

Functional Decomposition

As seen in Figure 1, the RoboBoat consists of 8 main functions; Support, Sense, Communicate, Process, Safeguard, Propulsion, Power, and Signal. The support function is for the stability and load carrying capabilities. The sense function is for the detection of surroundings and positions. The communicate function is for receiving and sending relevant information to the correct components. The process function is for interpreting the data received from the controller and data gathered by sensors. The safeguard function refers to the kill switch requirements (remote and manual) to be able to compete. The propulsion system is for the components used to move the boat, with turning and adjusting the speed of the boat. The power system refers to supplying energy to the boat components. The signal function is for the status of the operation of the boat (remote, autonomous, and if the emergency stop is active).
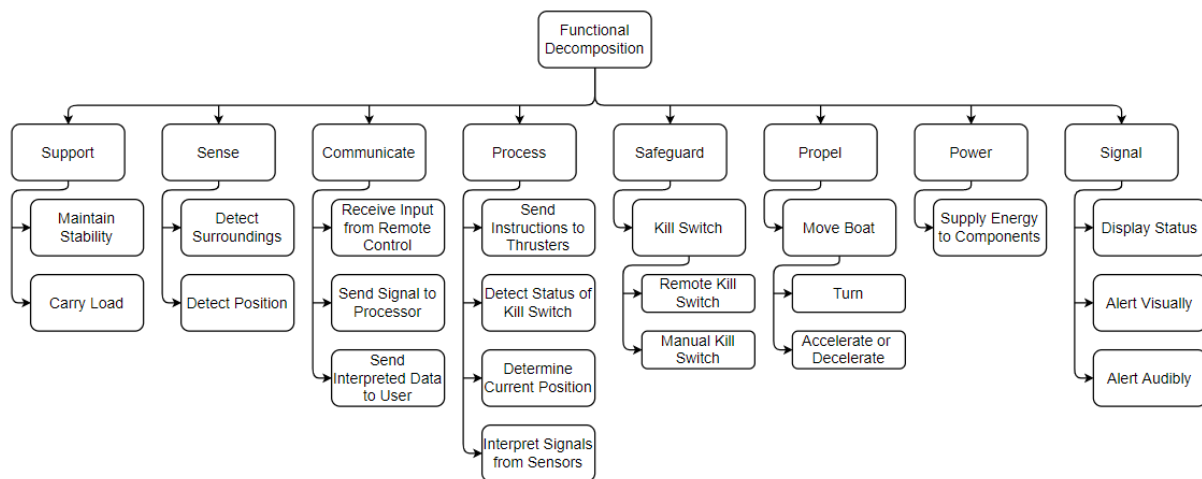
Figure 1: Functional Decomposition

<u>Function Relationships</u>

Support, Power and Propulsion are the main functions that will make the boat function, as without support there is no boat, without propulsion the boat is incapable of movement, and without power the propulsion/communication/process/signals can not function. Sense, Communicate and Process all directly relate as the sense function gives relevant environmental information to the processor, the communication function transfers remote and sensory data received from the sense function to the process function. The processor interprets the data received from the prior functions and determines the next action. The processor then tells the safeguard if it should activate, as well as how the propulsion system should activate, orient, or specify speed of the thrusters. It also updates the status of the signal function

Actions and Outcomes

The RoboBoat competition is a popular and growing autonomous boat competition. This boat

will be able to propel and navigate a series of obstacles autonomously along with remote

controller capabilities. The weight of the boat will allow for proper floatation, while the

propulsion system provides stable directional motion. With the challenge of maneuvering and

navigating, rotational motion and water friction will not cause the boat to capsize. The boat will

also have to be able to store any electrical components and accessories that are required by the

RoboBoat competition rules. The RoboBoat should be capable of completing the given tasks in

an efficient and timely manner in order to compete for the best time.

<u>Function Resolution</u>

The purpose of this project is to construct and engineer an autonomous boat with the capabilities of remote control use. The autonomous boat will handle high-speed, stable maneuverability through a timed obstacle course, complete a speed run, handle obstacle delivery, and be capable of docking itself.

<u>References</u>

RoboNation (2020). *RoboBoat Rules and Task Description*. (version 1). Daytona, FL: Retrieved

from roboboat.org