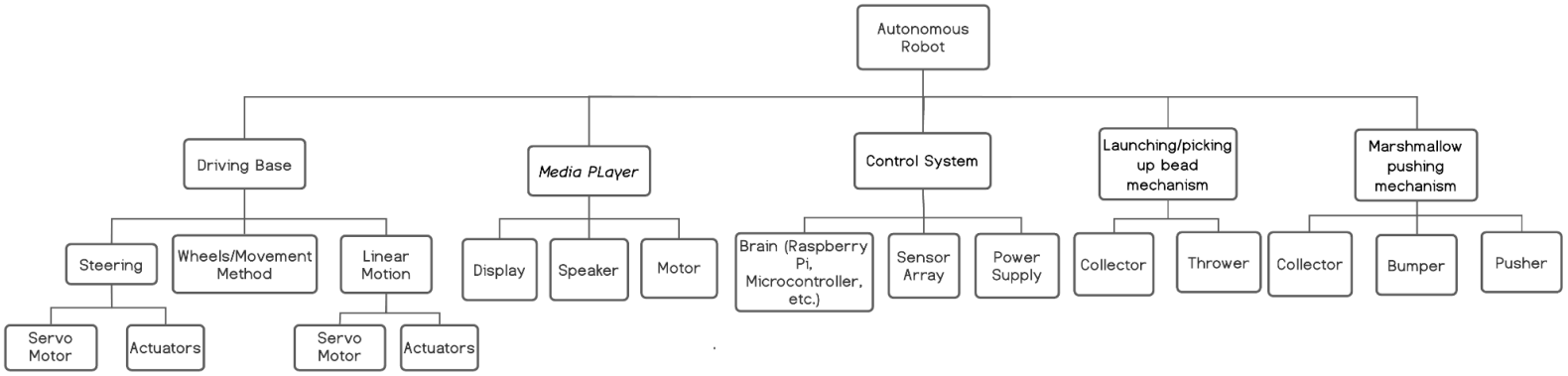
Functional Decomposition

Senior Design Team 301 SoutheastCon Hardware Competition 2022

The goal of the project is to build a robot to compete in the SoutheastCon Hardware Competition. The robot must perform a variety of tasks successfully in order to place highly in the competition. These tasks include: picking up/throwing beads, pushing marshmallows out of the way, completing a track in two directions that is littered with obstacles, playing a song, and having a display that moves mechanically/lights up. The following is a functional decomposition detailing all the modules that will be included in the robot in order to accomplish these tasks.



Customer Needs

No.	Need/Statement	Source
1	Adheres to competition specifications and rules	Rulebook
2	Pick up and throw/drop beads into fish nets and trash bins	Rulebook
3	Push the marshmallows off the roadway	Rulebook
4	Have a display that moves mechanically and lights up	Rulebook
5	Play a song	Rulebook
6	Complete the track in both directions	Rulebook

Cross-Reference Table

	Major Functions					
Minor Functions	Driving Base	Media Player	Control System	Launching/ Picking up Mechanism	Marshmallow Pushing Mechanism	Customer Needs
Steering	x		x	x	x	3,6
Wheels/Movement Method	x		x	x	x	3,6
Linear Movement	x		x			3,6
Display		x	x			4
Speaker		x	x			5
Media Player Motor		x	x			4
Brain	x	x	x	x	x	2,3,4,5,6
Sensor Array	x		x	x	x	2,3,6
Power Supply	x	x	x	x	x	2,3,4,5,6
Bead Collector			x	x		2
Bead Thrower			x	x		2
Marshmallow Collector			x		x	2
Marshmallow Bumper			x		x	3
Marshmallow Pusher			x		x	3

Level 0:

Module	Autonomous robot
Inputs	Power supply, Power switch, Control Module (Microcontroller)
Outputs	Actuators, All Mechanisms, Display Media
Functionality	Move through the track automatically while collecting and throwing beads, removing marshmallows from the play area, playing a song, and displaying something on a moveable screen.

Level 1:

Module	Driving Base
Inputs	Steering Servo Motors and Actuators, Movement Servo Motors and Actuators
Outputs	Wheels or other movement mechanism (track, etc.)
Functionality	Move the robot through the course.

Module	Display/Media
Inputs	Media Storage Device (USB, SD Card, etc.), Control Module
Outputs	Display, Speakers, Motor Movement
Functionality	Lights up the display that moves mechanically and plays a song

Module	Control System
Inputs	Power Supply, Brain(raspberry pi), Sensor Array
Outputs	Controls all mechanisms
Functionality	Enables overall functionality

Module	Marshmallow Pushing Mechanism
Inputs	Sensors
Outputs	Robot pushing mechanism (TBD)
Functionality	Pushes the marshmallow in the sensed wall opening

Module	Launching/Picking up Bead Mechanism

Inputs	Sensors
Outputs	Mechanism to pick up/throw/place beads (TBD)
Functionality	Picks beads from “tree” and throws them into the nets and/or Drops them into trash bins

Level 0 of the design is composed of the Autonomous Robot Module, which describes the needed inputs of the robot such as the power switch, power supply, and the control module. The output would be the robot's movement, mechanisms, and media, which allow the robot to perform all the necessary functions at the SoutheastCon Hardware Competition. Level 1, the modules that would make all the functions of level 0 possible, would be composed of the Driving Base, Display/Media, Control System, Marshmallow Pushing Mechanism, and the Launching/Picking up Bead Mechanism modules. The Driving base uses servo motor and actuator data to output to the wheels and other movement mechanisms in order to move the robotic platform. The Display/Media module will take in data from an input storage device in order to output video and music on the display. The Control System will use the data sensor arrays to control all the general mechanisms and overall functionality. Both the Marshmallow Pushing Mechanism and Launching/Picking up Bead Mechanism use the sensors to complete their tasks of pushing and placing/launching their respective objects toward their destination, the specific mechanisms are still to be determined.