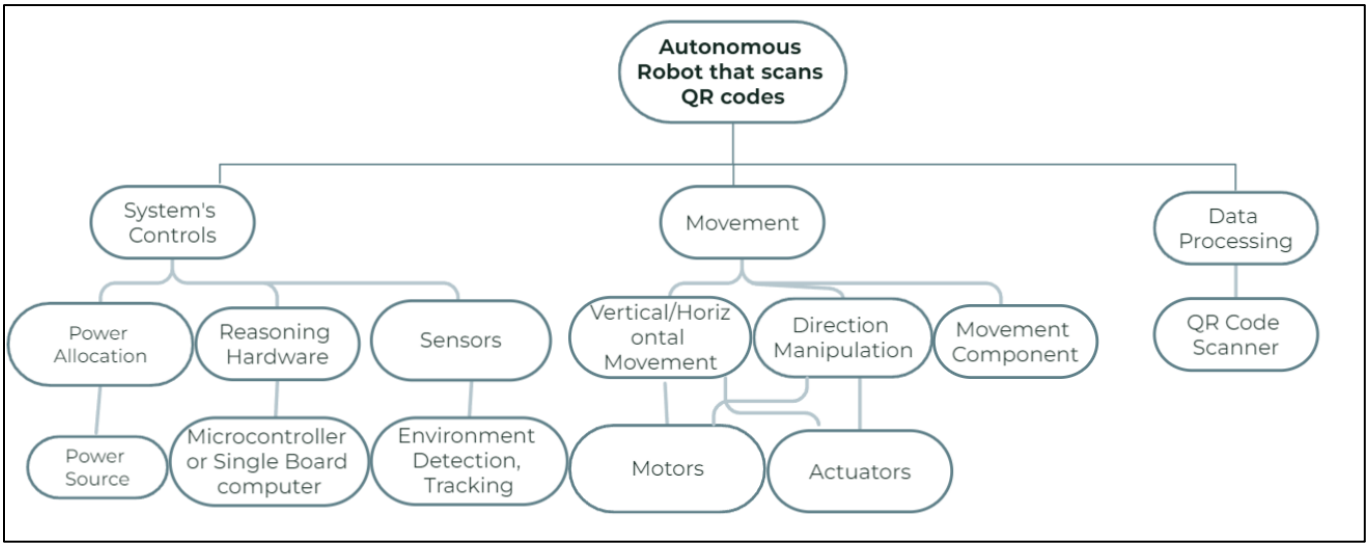
Team 308

Functional Decomposition

Brief Introduction:

The main objective of this project is to design, program, and build a robot to navigate an office environment without the use of GPS and scan a QR code located in a known location. The environment may include obstacles such as tables, chairs, doors, people, etc. The robot will use an IMU (inertial measurement unit) and/or visual information sensors to navigate the space and locate the QR code.

Function Tree:



Cross Reference Table:

Minor Functions	**Major Functions**			
	Movement	Data Processing	System's Controls	Customer Needs
Avoid Obstacles	x		x	4,7,3,2
Avoid Hitting People	x		x	4,7,3
Maneuver without GPS				5,9
Limit speed to human pace	x			7,6
Navigate on different building floor types	x			8,9
Navigate with lights on/off			x	9,8
Easily disable			x	12,3
Scan QR code		x	x	11

Record and Send Message		x	x	11

Decomposition Levels:

Level 0:

Module	Autonomous Robot that scans QR codes
Inputs	Power allocation, Reasoning Hardware, Sensors
Outputs	Operates motors, Scanner activation, Data Processing
Functionality	Robot that navigates an office environment without the use of GPS and scans a QR code located in a known location.

Level 1:

Module	Movement
Inputs	Actuators and Motors
Outputs	The wheels move
Functionality	Moves the robot vertically or horizontally.

Module	Data Processing
Inputs	QR Code
Outputs	Save the data, send data if required
Functionality	Will scan the QR code, saves the information, capability to send information.

Module	Controls
Inputs	Battery, Sensors, Microcontroller or small computer
Outputs	Data for object distance, power for robot, integration of all parts
Functionality	Provides power needed to move the robot and complete task, key information about people and object detection, and makes everything work.

Level 2:

Module	QR Scanner
Inputs	QR code
Outputs	Data is scanned, processed, and transmitted.
Functionality	Scans the QR code then saves and sends message.

Module	Sensors
Inputs	People, obstacles, light
Outputs	Information about the environment
Functionality	Tells the robot what is around, and what to avoid.

Module	Reasoning Hardware
Inputs	Data from sensors and battery
Outputs	Wheels move, robot turns, scans qr code
Functionality	The robot operates as it should.

Module	Battery
Inputs	Switch, button
Outputs	The robot has power
Functionality	The robot is able to operate as necessary.

Summary:

Level 0 in this functional composition is made to describe what the overall goal of the project is which is to create a system that navigates an office environment without the use of GPS and scan a QR code located in a known location while avoiding obstacles and people. Level 0 also shows some of the inputs that it will need to operate successfully. Level 1 was made to explain what is necessary to be implemented to make sure that Level 0 can work. The movement of the robot will be made possible by components such as the wheels, actuators, and motors. The data processing of the robot will be made possible by components such as the QR scanner which will play a big role in scanning the necessary QR code which will make the message processing possible. The controls of the robot will be made possible by components such as the raspberry pi, the battery to provide power supply and the sensors which will play a huge role in meeting the customers' needs. Level 2 describes how the components work together to make Level 1 possible. Overall, each level works together to make the final goal possible.