Team 307

Concept Generation

Tool used to develop the list of concepts: Concept Brainstorm, Morphological chart, and Biomimicry.

Morphological Chart

Power Allocation/ Distribution	Reasoning Hardware	Sensors	Movement/ Direction Manipulation	Qr Code Scanner	Robot Frame
Lithium Polymer Batteries	Raspberry PI 4	Inertial Metric Unit	Rigid caster wheels	RGBD Camera	Sheet metal
Power Distribution Board	Arduino Mega	IR Sensor	Swivel caster wheels	Arduino QR Code reader	Plexiglass
Nickel Metal Hydride Batteries	BeagleBone	LIDAR sensor	Brushed or Brushless DC Motors	Raspberry Pi Camera Module V2	Aluminum
Lithium-ion Cells	Rock Pi	Ultrasonic Sensor	Linear Actuators	Zed Mini	5-7 Ply Plywood
Cut-off Switch	TS-7970	RGBD Camera	Actuator Control Board	RGB Camera	Steel
Voice Recognition Cut-Off power	Arduino Uno	Light Sensor	Omni wheels	Go Pro Camera	Fiber Glass
Gasoline Powered	Arduino Nano	Proximity Sensor	Caterpillar track	DSLR	Plastic
Battery & Spring Powered	Raspberry Pi 3	Bumper Switches	Mecanum	Akaso V50	Titanium
Ethanol Powered	NodeMCU	Microphone	Uni Wheel (ball)	Oclu	Tempered Glass
Solar Powered (like a calculator)	LattePanda 3 Delta 864	Hall Effect	Magnets	DJI Asmo Action	Carbon Fiber
Methane Powered (from compost)	Teensy 3	Current sensor	Hover craft	Charmed Labs Pixy 2.1	Iron

Hydrogen Fuel Cell	TI MSP Line	Radar	Bipedal	Arducam 8MP	Aerogel
Nuclear Powered	LattePanda 3 Delta 864	Probe Type Heat Sensor	Quadrupedal	Ultraleap Stereo IR	Stainless Steel
Electron Powered	NVIDIA Jetson	Voltage Regulator	Hexapod (spider legs)	Ultraleap 3Di Hand Tracking Camera	Rubber

Medium Fidelity Concepts

Concept 1:

- Power: Lithium-Ion Cells
- Reasoning Hardware: Raspberry Pi 4
- Sensor Suite: Lidar, IMU, RGBD Camera
- Locomotion: DC Motor with castor wheels
- Frame: Plastic

Concept 2:

- Power: Lithium Polymer Batteries
- Reasoning Hardware: Arduino Mega
- Sensor Suite: IR Sensor, RGBD Camera, IMU
- Locomotion: Caterpillar Track
- Frame: Plexiglass

Concept 3:

- Power: Lithium Polymer Batteries
- Reasoning Hardware: BeagleBone
- Sensor Suite: LIDAR, RGBD Camera, IMU
- Locomotion: Linear Actuators
- Frame: Plastic

Concept 4:

- Power: Lithium Polymer Batteries

- Reasoning Hardware: Raspberry Pi 4

- Sensor Suite: LIDAR, RGBD Camera, IMU

- Locomotion: DC motor with castor wheels

- Frame: Aluminum

Concept 5:

- Power:

- Reasoning Hardware:

- Sensor Suite: LIDAR, RGBD Camera, IMU

- Locomotion: Actuator control board with uni wheel

- Frame: Carbon Fiber

High Fidelity Concepts

Concept 1:

- Power: Lithium Polymer Batteries

- Reasoning Hardware: Raspberry Pi 4

- Sensor Suite: LIDAR, RGBD Camera, IMU

- Locomotion: DC motor with castor wheels

- Frame: Aluminum

Concept 2:

- Power: Lithium Polymer Batteries

- Reasoning Hardware: Arduino Mega

- Sensor Suite: IR Sensor, RGBD Camera, IMU

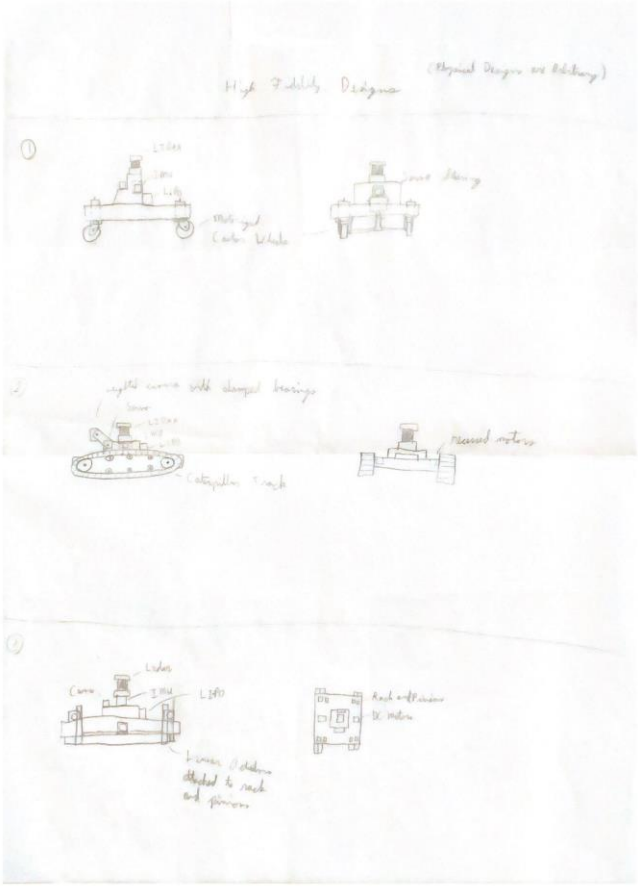
- Locomotion: Caterpillar Track

- Frame: Plexiglass

Concept 3:

- Power: Lithium-Ion Cells

- Reasoning Hardware: BeagleBone
- Sensor Suite: LIDAR, RGBD Camera, IMU
- Locomotion: Linear Actuators
- Frame: Plastic



Concept Brainstorm

Mechanical Engineering Solutions

1. Basic skateboard with wheels that battery and sensors attach to.
2. Basic skateboard with tank-like treads that battery and sensors attach to.
3. Car-like mobile device with an arm to open doors and push obstacles out of the way.
4. A car-like mobile platform with small detachable part that separates from the main body to navigate obstacles, scan QR code and return to main body (think detachable space shuttle fuselage).
5. Car-like mobile platform that uses auditory queues from the environment to aid in obstacle avoidance.
6. Bipedal mobile robot – the ability to traverse rugged terrain.
7. Quadrupedal mobile robot.
8. Car-like mobile robot with built in microphone and speaker (like Amazon's Alexa device) to activate it, turn it off, and reply with success QR scan.
9. Car-like mobile robot that beeps loudly when a moving obstacle approaches (backup beeper on modern cars).
10. Motorized uni-wheel (a ball) with mounted sensors for navigation and scanning.
11. Three-wheeled mobile device that battery and sensors attach to.
12. Three-treaded mobile devices that battery and sensors attach to.

Software Engineering Solutions

1. Use an A* algorithm to find the best path for the platform to take to the QR code.
2. Use a minimax algorithm to find the cheapest path to the QR code in terms of distance.
3. Use an interrupt to immediately put the platform to a halt after detecting an obstacle with the camera.
4. Use a greedy search algorithm to find the best path to the QR code in terms of time.
5. Have the QR code scanner be lifted by an arm to reach higher areas on the wall.
6. Have the QR code scanner be tilted backwards to scan higher areas on the wall similar to a pan tilt inspection robot.
7. The robot's base can be a rumba, so it will travel the entire room till it scans the Qr code.
8. Lift the platform to scan QR code on wall.
9. Flash for taking QR code in the dark.
10. Play a sound when in proximity to people.
11. Use IR and ultrasonic sensors to detect people.
12. Have a button on top of the platform for workers to press that sends the halt interrupt.
13. Handles to pick up the platform.
14. Display to communicate errors and status messages.
15. LED status array on platform.

16. Use a lower powered Arduino for simpler tasks that don’t need as much processing power.
17. Use Rasberry Pi to take in data from all sources (arduinos, sensors) and make decisions.