ModBot

Project Definition Document

4CAD

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Authors

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Version History

Date	Document Version	Documented Revision History	Document Revisor
11/20/17	1.0.0	Initial Revision	Vincent Davis
12/09/17	1.0.1	Update Document	4CAD
12/13/17	1.0.2	Project Lead's Requests	4CAD

Approvals

Date	Document Version	Approver Name and Title	Signature

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Purpose

To design and develop a modular robot that fulfills multiple functionalities based upon the user's needs.

Problem/Opportunity

The technology to be developed must be able to adapt to changing functional needs. Modularity is paramount, and therefore is to be emphasized throughout the entirety of the project lifecycle. Once software development is completed, the user should only be responsible for adding or removing parts from the robot, allowing the robot to gain or modify its functionality to meet a new need.

Project Goal

The goal for this project is to develop the robot to fit a single use case and developing differing functions to accomplish this use case to meet modularity requirements.

Project Objectives

- Define a use case
- Define functions to accomplish the use case
- Brainstorm use case implementation
- Research and procure materials
- Program the robot to accomplish different functions

Project Scope

- Build project website
- Define use case and functions
- Research and gather parts
- Consider YOLO/OpenCV for camera
- Implement the robot
- Review with customer and stakeholders
- Present

Key Stakeholders

- Bardh Hoxha
- Houssam Abbas
- 4CAD: Vincent Davis, Christian Garcia, Kole Cralley, Courtney Kinnard
- Testing Lab Environment Owners / SIU Computer Science Department
- SIU Carbondale students and faculty

Outcomes/Success Criteria

For this project to be considered successful, the robot should have the snap-on sensor functionality, as well as be able to complete the perception task of identifying its surroundings. Ideally, this project would also entail the completion of the navigation task: being able to create a path to its destination.

Assumptions and Constraints

Assumptions

- Have a dedicated space to practice and test
- Have libraries readily available to use
- Have parts that will be used for snap and go
- Acquired parts will be in on time and work as intended
- Mentor support/assistance

Constraints

- Time
- Budget
- Figuring out how to work the readily available libraries
- Learning curve in robotic development for most members
- Limited space/access

Risks

- Time constraints
- Learning curve in robotics development
- Working with sensitive parts
- Difficulty integrating sensors with the rest of the hardware
- Parts may not work as intended upon original purchase
- Software may not be compatible with certain hardware components
- Mapping techniques may be too processing-intensive
- Further modifications to the system to meet use case may result in subtle scope creep

Estimated Cost

Low-end Robot base cost: $106.89
Medium-end Robot base cost: $486.91

Estimated Duration

January 16 - May 4, 2018

Functional Requirements

Name	FR-1
Summary	Have a robotic platform that can move around a work space
Rationale	Robot must be able to move in order to satisfy use cases
Requirements	Robot utilizes sensors and mechanical attributes to effectively move around a space, avoiding obstacles.

Name	FR-2
Summary	Have a modular attachment point that can fit different sensors and actuators
Rationale	The base should have parts (sensors, mechanical arms, etc.) which 'snap' onto it to assure modularity.
Requirements	The base should have an attachment point to accommodate this "snap-and-go" modularity. This might be accomplished through the use of magnets.

Name	FR-3
Summary	Have the code detect which sensor/actuator is connected and make the necessary changes to the behavior.
Rationale	This requirement supports the modularity and "snap-and-go" component, making the robot more accessible and easy to use without the consumer having to do any coding.
Requirements	Appropriate libraries must be utilized to detect attachment changes.

Name	FR-4
Summary	Assure the system has fully functional perception and navigation capabilities
Rationale	In order to accomplish the use cases, the robot must be able to "see" what is around it and avoid obstacles in order to reach its intended destination.
Requirements	The robot will need to utilize various sensors, such as a camera and software libraries like OpenCV.

Name	FR-5
Summary	Easy-to-use interface to tell the robot what to fetch
Rationale	The object of this use case is to decrease the effort required for a user to retrieve a desired object. The interface should enhance this efficiency and usability.
Requirements	Voice Recognition capabilities would contribute to the efficient and hands-free nature of this use case.

Non-Functional Requirements

Name	NFR-1
Summary	Increase efficiency in fetching objects
Rationale	The purpose of the use case our project will be focusing on is to fetch objects and return them to the user, thus decreasing the total necessary effort on the part of the user.
Requirements	The user should be able to complete the task of fetching the desired object with less total effort and in less total time than completing such a task without the aid of the robot.

Name	NFR-2
Summary	Make and test the platform for under $1,000
Rationale	The budget for this project is $1,000, which ensures that our project can be completed in the most responsible way possible, while still pursuing all avenues for research and development potential.
Requirements	This project must be completed for a total of $1,000 or less.

Use Cases

Our design will be useful in workstation environments where it would be a waste of time to leave the station to fetch something. An example would be in an auto shop where if someone is working on a car and normally to get a new tool would have to stop what they are doing to get it.

Date:	12/13/2017
Approved by:	
Approver Signature:	
Mentor Name:	Houssam Abbas
Mentor Signature:	(see attached email)