Phase II: Refined Product Proposal

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Project Concept: Roomba room mapper / remote control

Project Description:

While the Roomba already employs an array of sensors to efficiently and automatically vacuum a room in a household, its algorithms are still based on estimates. With current technology, it is possible to extend these approximations by physically mapping out a 2-D representation of the floor plan and subsequently covering every foot once mapping has been completed. Ideally, this should prevent a Roomba from getting caught or running over the same piece of ground over and over. In addition, a mobile app could be created that can view the current position of the Roomba in its self-created floor plan. If the Roomba is stuck or is finished with its work, it will notify the mobile app via Bluetooth or Wi-Fi.

Stakeholders:

- User:
  - Homeowners
  - **Requirements:**
    - *Reliability*- The Roomba clearly already has a decent room cleaning algorithm otherwise the automated vacuum cleaners would be off the market by now. The floor plan visualizer needs to be extensive enough to make the old algorithms obsolete.
    - *Connectivity*- The interfacing with a mobile device via Bluetooth or Wi-Fi needs to be a trustworthy addition otherwise it will just cause more headaches than are necessary.
    - *Extensive Memory*- Variable size floor plans need to be accommodated by the floor plan mapping and likewise this will put an emphasis on memory in this new device.

- Client
  - iRobot / Robot manufacturer
  - **Requirements:**
    - *Compatibility*- This technology is essentially designed to be an extension on the already existing iRobot application, consequently it needs to be easily importable into the existing hardware setup without much re-engineering
    - *Fully Functional*- The extension for Roomba needs to be fully functional because these devices are already on the market; this is not an experimental device that is being worked on.
    - *Cost Effective*- The Roomba is already a pretty pricey robot so any extension on its functionality should not extremely bump up the price otherwise it might alienate the audience already out there.

- Designer:

- Student Group
- **Requirements:**
  - *Robust Algorithm*- The floor plan mapping algorithm needs to be robust when facing infinite variation in floor configuration
  - *Simplicity*- Given the short time span allotted for the project, the programming cannot venture into the extremely experimental because it will likely not produce any useful results in the timeframe.

Practicality:

- Multi-faceted project that incorporates a hardware and software aspect will require a multi-talented team to tie this project together.
- Software aspects include both the internal algorithm running on the Roomba to map out the room and the associated mobile app that would communicate with the running robot
- While the hardware aspect is not too extensive, it still involves incorporating the new software into the Roomba as well as a wireless broadcasting device (Bluetooth or Wi-Fi) that could sync with the mobile app
- The feasibility of the project within the 1 year timespan depends on the team working on the project as well as the final agreed upon scope. The project can be as complex or as simple as it can be while still providing a good amount of functionality
- Overall, the project is feasible within the timeframe even if it means sacrificing the additional functionality of the mobile application

Required Skills:

- Software Expertise
  - A lot of this project comes in the form of software writing whether it be for the possible mobile app or for the internal software for the Roomba that will keep track of its current position within a floor plan mapped out by it.
- Possible Kinect Experience
  - Depending on the complexity of the floor plan mapping algorithm, Microsoft's Kinect is a possibility for mapping out the individual rooms that the Roomba is up against
- Hardware / Network Experience
  - Pairing the Roomba with mobile apps has been done before and this can been seen clearly on the Google Play store. Likewise, the hardware introduced would need to perform a similar functionality and possibly include the functionality of manual override that many of the existing apps have.

SWOT analysis:

- Strengths
  - Has the ability to give Roomba the functionality that everybody always hoped it would. It would have the ability to cover as close to 100% of a room as possible by an autonomous robot
  - Has the ability to attract the attention of iRobot if it is a successful project because of its upgrade on the existing software.

    - The possibility of using Kinect would really harness the forefront of imaging technology
- Weaknesses
    - Could be a complex project even without incorporating Kinect. Mapping out a random floor plan is not a simple task.
    - Might already be in development, the Roomba is not a new piece of technology and likewise it is likely that other teams have thought out this challenge before
- Opportunities
    - A lot of room to expand on whether it is the use of Kinect or developing a mobile app side by side
    - The ability to spawn a new generation of Roomba robots that could have even more applications than just house cleaning
- Threats
    - The complexity of the project poses a big roadblock that would take more manpower to overcome in the allotted timeframe
    - The Roomba itself is an expensive piece of hardware to acquire and likewise the project would likely not be able to get off the ground without the proper funding.