Final Project Proposal

Year: 2022 Semester: Spring Team: 2 Project: VRms

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Team Members (#1 is Team Leader):

Member 1: Brian Latimer Email: blatimer@purdue.edu

Member 2: Emma Clary Email: clarye@purdue.edu

Member 3: Matthew Wen Email: wen101@purdue.edu

Member 4: James Donnelly Email: donnell9@purdue.edu

1.0 Project Description:

VRms is a VR (virtual reality) program that allows a user to control a robot arm via a VR simulation to complete tasks in an environment that is unsafe and unsuitable for direct human interaction. The VR controller movement will translate to positional/rotational data of the simulated motors to the real robotic arm that will mimic this movement in real time. This translation will allow our robotic arm to perform certain actions based on the movements of the VR controller, giving workers the ability to complete unsafe tasks in a safer location.

2.0 Roles and Responsibilities:

1. Team Leader: Brian Latimer

* Brian Latimer is a Computer Engineering major. He has experience with embedded software development, Unity, and software development for a variety of projects. He has had prior leadership experience within his EPICS team, as well as leading his hackathon team to win the award for “best financial hack” at Boilermake VIII. He will be responsible for the VR simulation along with assisting with all parts of the project.

1. Systems Engineer: James Donnely

* James Donnelly is a Computer Engineering major. He has experience with software development, ASIC design, and Google Cloud, as well as front end development with NodeJS and React. Having worked at small agencies to large corporations like Rolls-Royce, he has a range of experiences with working on big and small teams on projects with timelines spanning from weeks to decades. Here in Purdue ECE, James is involved with HKN and ECE Ambassadors, where he works with Matthew Wen on web development for a number of projects.

1. Hardware Engineer: Emma Clary

* Emma Clary is a Computer Engineering major. She has experience in robotics, embedded software development, and electromechanical projects from various internships and clubs. She was a team leader on her FIRST robotics team during high school, giving her a chance to develop different skills that are needed for a complex robotics project. She also worked on an electromechanical project at Allegion which required embedded programming and design. At L3Harris she was on a team working on developing ways to communicate between the hardware and software in a robust way. All of these experiences will allow her to lead the team to success as the hardware engineer.

1. Software Engineer: Matthew Wen

* Matthew Wen is a Computer Engineering major. He has experience in Devops with Google Cloud and AWS, and experience in coding in different program development like NodeJS, React, GoLang. One of my favorite courses is ECE 468. He also creates multiple projects, including being responsible for the web dev committee for ECESS, located at <https://www.purdue-ecess.org>, and creating Discord bots like the Queueup Bot for ECE 264. He will be working full time at Lab126 as an SDE for Alexa.

2.1 Homework Assignment Responsibilities

| *Design Component Homework* | | *Professional Component Homework* | |
| --- | --- | --- | --- |
| 3-Software Overview | MW | 9-Legal Analysis | JD |
| 5-Electrical Overview | EC | 10-Reliability and Safety Analysis | MW |
| 7-Mechanical Overview | BL | 11-Ethical/Environmental Analysis | EC |
| 8-Software Formalization | JD | 12-User Manual | BL |

3.0 Estimated Budget

| **SOFTWARE - $70** | |
| --- | --- |
| 3rd party Kinematics package for Unity | $20 |
| Google Server | $50 |
| Open Source Software | $0 |
| **HARDWARE - $430** | |
| Motors w/ Encoders | $140 |
| Extra robot arm parts | $50 |
| [Stereo Camera for Raspberry Pi](https://www.uctronics.com/arducam-2mp-stereo-camera-for-raspberry-pi-nvidia-jetson-nano-xavier-nx-dual-ov2311-monochrome-global-shutter-camera-module.html) | $150 |
| Base/Packaging | $30 |
| Step down converters | $10 |
| Project Circuit Board | $50 |
| STM32 or ESP32 | Provided |
| VR Headset | Provided |
| Robot Arm | Provided |
| Wall Outlet 12V Converter | Provided |
| **TOTAL** | **$490** |

4.0 Project Specific Success Criteria

Hardware:

1. An ability to transmit data between the raspberry pi and the microcontroller through a wired connection.
2. An ability to control the servos to reach a position to +/- 5 degrees on the robot arm.
3. An ability to read encoder data to confirm servo position.

Software:

1. An ability to transmit data from the server to a Raspberry Pi wirelessly with a latency of less than one second.
2. An ability to compute motor angles in Unity and send that data to the server with a latency of less than a half of a second.

5.0 Sources Cited:

“US20160257000A1 - Robot Control, Training and Collaboration in an Immersive Virtual Reality Environment.” *Google Patents*, Google, 2015, <https://patents.google.com/patent/US20160257000A1/en>.

“US10919152B1 - Teleoperating of Robots with Tasks by Mapping to Human Operator Pose.” *Google Patents*, Google, 2018, <https://patents.google.com/patent/US10919152B1/en>.

“US20130211592A1 - Tele-Operation System and Control Method Thereof.” *Google Patents*, Google, 2012, <https://patents.google.com/patent/US20130211592A1/en>.