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Virtual Reality Environment of Excavator Training for Operation License

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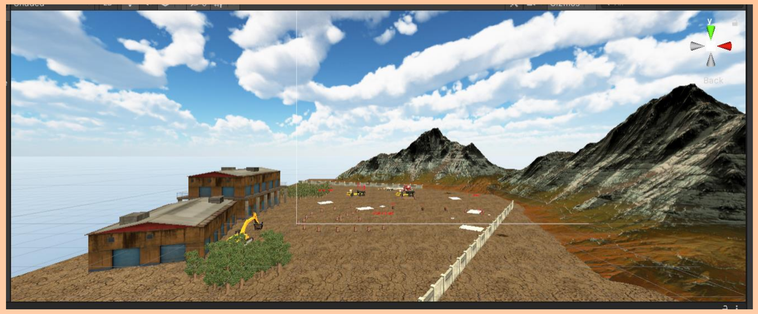
Abstract

In 2018 unfilled construction worker jobs rose to 404,000[1]. This was an all-time high, according to the Bureau of Labor Statistics Job Openings and Labor Turnover Survey. The government has no restrictions for operating an excavator; however, it is impossible to get a job without any operation and competency documentation. For this documentation, an employer could be looking at about $1000 for the most highly recognized training, which must be reinstated every five years. Excavation operation is a highly sought-after profession, and jobs are expected to rise by over 10% until 2028. The NSF EPSCoR research project is creating a Virtual Reality environment that will allow both residential and commercial jobs to train and teach employees how to operate excavators safely and competently. The Virtual Reality scenario will also allow employers to reduce the cost of operation and competency training. As a result, several workplace scenarios have been developed that can fully amerce an excavator operator into their training and safety.

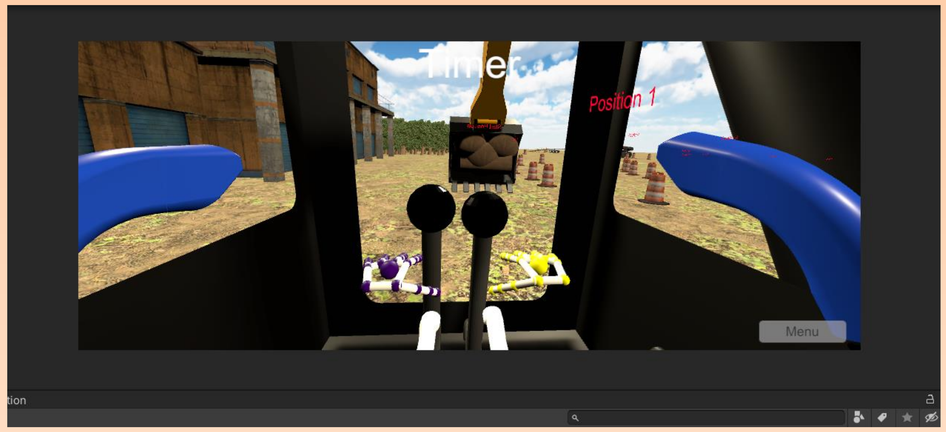
Teaching Outside the Seat

With the ever-growing advancements in Virtual Reality's abilities, it economically beneficial to use VR to its full capacity. VR has been used greatly throughout industry as a leading training aid. With VR's growing affordability and advancements with versatile scenarios, VR for heavy machinery operation training can become more desired. With a hybrid of electromechanical systems and Unity 3D all the operational needs of heavy machinery are available at your fingertips. Virtual scenarios also create a fun learning environment that will draw those who are familiar with its technology. While complete learning will need to still be on actual machinery VR scenarios will get trainees closer to real operations licenses faster.



Above: Full interaction with an in-game menu allows for full at operators needs training. Ultimately this environment will play and operate as a video game.

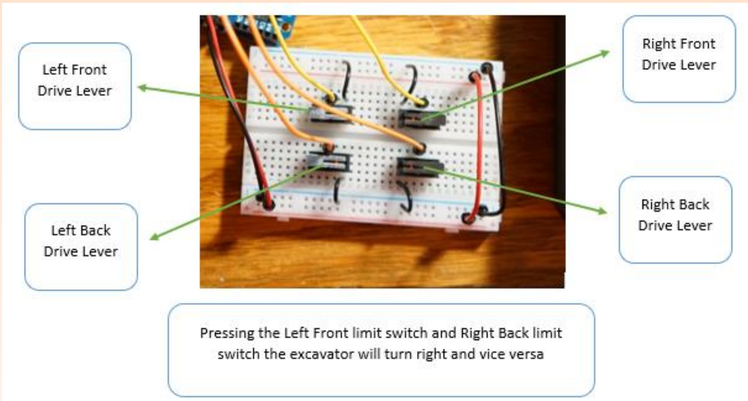
Above Right: A satellite view of the driving practical test course with a leading industry excavator. Environment is different terrains, scenes, and textures collected.



Above: This is a game view of what an operator would see sitting in the seat of a real excavator. This environment will be fully 360 degrees with sounds and feelings hopefully.

Above: The addition of a firebase login system allows for complete data recording though internet database.

Right: The limit switches are connected to a breadboard with Arduino interface that completes the external drive lever capability of the environment.



Environment

With the Safety and Operation Training of Excavators scenario trainees and trainers will benefit in:
1 – Excavator Maneuvering: With a hybrid of simple USB Joysticks, and Arduinos the complexity of excavator maneuvering will be minimized greatly with the ability to learn while not needing to worry about damaging actual equipment in the process.
2 – Excavator Competence: One important step to an excavator operation license is a trainee's competency level. With the large amount of accessibility and actual training scenarios a trainee can completely drive an excavator with full support from his/her instructors.
3 – Excavator Safety: Operating an excavator is no small task. On average workplace injuries are caused by heavy machinery operators. This scenario will train in an engaging way not only operations but how to operate safely while maximizing your dig time. Safety is the most important however, it should never feel like a punishment.
With this environment a few complications did arise within the coding such that bucket scooping and dirt visibility isn't as smooth as originally hoped. Also, It was established early on that visibility inside the environment excavator was nearly impossible and no textured glass was clear enough.

Future Direction

Currently the environment has a full mockup of an excavator practical driving test with complete integration. It is the hope of this project that a fully completed project will be finished. With a full ability to log onto an internet database that holds scoreboard data and ability to be an appropriate means to log any excavator operator practical test.

References

1. Unfilled Construction Jobs at Post-Recession High. (2019, June 12). Retrieved from http://nahbnow.com/2019/06/unfilled-construction-jobs-at-post-recession-high/