

Thesis Project Portfolio

Smart Sprinter

(Technical Report)

Cobalt Mining in the Democratic Republic of the Congo

(STS Research Paper)

An Undergraduate Thesis

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Sociotechnical Synthesis

The capstone project was to create a track block sensor that optimized track sprinters start off the block during track practice. The project had three points to measure. The first point was to measure the track sprinters force off of the block. This was to see how strong the runner is off the block, and if their force was optimally pressed into the block and there was no mess up. The second point was to measure block exit time. This was the time it took the runner to leave the block from when the start was initiated. This was in a way to see their reaction time and to train them to time when to leave the blocks to shave time off of their runs. The final point of measurement was a height laser sensor. This sensor had an adjustable height with a magnetic attachment to allow adjustability for the runner's preference. In addition, it can be set at any distance from the block within the wire's reach, to make the runner's height adjusted at any point during the start. This was to ensure that the runner stayed low when starting, in order to optimally translate their force forward, and not upwards as many first-time sprinters jump up from the blocks instead of driving forward.

After these data points were gathered, they were then processed into a readable graph and saved runs in a data sheet. This graph showed the start time, block exit time based off of when the peak force dropped off as the last foot left the block, and the peak force of each foot. The user can also see the force throughout the process and can see which foot produced which force and when it left the block. This can make the runner more aware of how each foot works with each other, and to make adjustments to give them a more optimal start. Finally, the chart showed whether the runner triggered the height sensor or not. Not triggering the height sensor meant that the runner went under the laser, and through video footage could see if this translated into more forward force instead of upwards. Through this data, the runner throughout can make

adjustments during practice and can even practice on their own with a built-in start delay button that allows them to get into the block in time and hear the buzzer to start. With this data, track sprinters can optimize their start, and this device can encourage other youth runners to get into track sprinting.

The STS paper explores the ethical dilemma with cobalt mining in the Democratic Republic of the Congo (DRC). Cobalt is a vital mineral used to make technologies, specifically cobalt cathodes for lithium-ion batteries which is used in the capstone project. Through background research, it was found the conditions that the miners go through and the way the industry is set up make the industry unsustainable and ethically wrong in the long run. This led to the research question, which is “are there alternative methods to artisanal mining and finding more sustainable practices that empower local communities whilst being realistic with the demand of Cobalt for the global supply chain?” The paper explores three solutions to the question, that will transition the country away from cobalt mining by being realistic about the global supply chain, and open opportunities for new more ethical industries in order to not abandon the communities.

The first solution is to institute government reform. The past for this country has partially led to its current instability and therefore has detracted outside investors that are not involved with the cobalt mining industry. Outside investors are needed in order to improve the DRC’s infrastructure, which is the second solution in order to bring in other industries to reduce dependency on the cobalt mining industry and give miners a new path. The third solution to this problem is to continue research into cobalt-free cathodes for technologies. These technologies are not only cheaper and more efficient but would reduce the demand of cobalt. Only in recent

years with the technological boom has cobalt demand, and therefore cobalt mining sore, leading to these brutal working conditions to spread on a mass scale.

This ethical dilemma with cobalt mining only occurs due to cobalt's immense value to the entire world, and that the DRC has most of the worlds cobalt. Reducing dependency globally on this mineral will turn the country away from the brutal mining industry. In addition, government reform combined with infrastructure development will attract different, more ethical industries to move into the DRC. This will allow the miners to transition away from the cobalt industry when cobalt demand is lessened. This is vital in order to not have these mining communities completely abandoned and instead give them a new lifeline into prosperity and growth.