

Samuel Rhodes Labman Automation Report

During my time at Labman I was given a wide variety of projects across a spectrum of fields including pneumatics, electrical, electronics, programming and CAM mechanism design. Projects included building and programming an extraction and filtration robot, creating Nylon 3D Printed adaptors to pioneer a new range of semi-automated pipettors and creating a new iteration of a fully pneumatic cheese piercing machine.

My main project was an extraction and filtration robot. It used a series of syringe pumps in conjunction with a vacuum to force proteins through filter paper into a test-tube containing plant leaf extracts. This project involved improving upon the existing mechanical design before assembling, wiring, and programming the robot. I found this rewarding and I further built on my knowledge of IPCs (industrial PCs) and mechanical design. I worked with Sink and Source IPCs, which were interfaced with a series of Syringes, sensors and Pneumatic Cylinders. I learnt to use C# and WPF to interface and control the robot. I developed my mechanical competencies and deepened my electrical understandings of schematic design. I learnt to create pneumatic diagrams and gained invaluable programming expertise in C#.

I undertook an R&D project to modify an existing handheld pipettor product for automation on one of our future robotic systems.

I was instrumental in further developing a pneumatic cheese piercing robot. The premise was a low cost, durable, purely pneumatic machine to spike cheeses. This enabled mould spores in the cheese to mature when exposed to oxygen. Currently the manufacturer relies on hand-stabbing the cheese which is both costly in time, and often leads to repetitive strain injuries. This was a challenging project with many constraints; for instance; the environment meant that electrics were not suitable and therefore we utilized 2 pistons to both rotate and periodically spike the 2kg cheeses. I developed a series of CAM mechanisms to drive rotation of the cheese, choosing eventually to utilize a living hinge ratchet system. This enabled accurate rotation in 20 indexed positions. I learnt when to change design tactics after several iterations of CAM Mechanisms. To control the system, we implemented pneumatic sequencing. This used a series of signal generators and valves, to alternately cascade cylinders. When paired with a counter, it enabled the entire robot to use one air supply with 2 safety buttons to rotate and spike the entire cheese before automatically stopping. This project widened my understanding of pneumatics as well as setting a precedent in the dairy manufacturing industry.

I designed and built a soak testing rig to control stepper axes via a custom stepper driver board whilst electromechanically protecting the boards from programming whilst simultaneously running.

Personal Achievements

Amongst many things I achieved, I view my biggest success as the extraction and filtration robot that I worked on. I encountered many issues with the underlying initial conceptual design, which I had to troubleshoot and improve. From there I learnt to create and implement pneumatic schematics. I used C# to interface to and control a host of syringes, sensors and valves to operate the robot. Upon completion of my employment, I had developed a robot capable of demonstrating initial proof of concept filtration sequence for the client. The robot will shortly be used by the client as part of a larger automation project.


The pneumatic cheese piercer was another achievement. This was a tricky project because of its simplicity. Due to budget and environmental constraints, the entire system needed to be pneumatic. This meant a reliable CAM mechanism needed to be developed so the robot could utilize cascading pneumatic decay valves to drive the entire system.

I am proud that I have been able to improve my programming skills. I self-taught myself WPF and C# alongside working in my spare time. I was able to implement these skills in several projects I undertook throughout my employment.

I upgraded my time management and planning skills to balance the plethora of projects I undertook.

I recognise I have developed my ability to independently problem solve. The independent nature of Labman encouraged me to use first principles thinking to investigate problems, before proposing and implementing suitable solutions. This positively impacted my engineering and critical thinking skills. I believe this has significantly improved my self-proficiency as an engineer.

Following my placement, I was given appraisal and invited to return in the future.


19.10.20

Employer Testimonials

Mark Walton-Senior Project Leader:

"Sam has good communication skills, asks relevant questions when required. Has worked on a good spread of projects/technologies and performed very well. Great feedback from the other team members for which Sam has been working with. I would gladly welcome Sam back to Labman!"

Phil Biggs-Senior Project Leader:

"Sam built the much-needed Stepper-Board Test Rig (for in-house testing of our custom stepper driver boards) and worked on this with enthusiasm and creativity. He kept me informed of progress and asked relevant questions whenever necessary. He worked well with others and was clearly a popular member of the team during his stay. I hope to see him back at Labman when possible."


Sam Nichols-Senior Project Leader

" Sam provided us with an excellent service and was never at a loss to add his valuable penny's worth."

Andrew Whitwell-Managing Director:

"Sam immediately grasped what it took to communicate well and make himself invaluable. Unparalleled enthusiasm. It would be interesting to challenge him more! Good learner. A must to get back."

Signed:



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A. WHITWELL

19 October 2020