GRITAUTOMATION®

TOOL-LEVEL

ACCESS CONTROL

ENHANCING SAFETY, EFFICIENCY, AND RESOURCE MANAGEMENT IN EDUCATIONAL SHOPS

Executive Summary

Educational institutions increasingly recognize the value of makerspaces, woodshops, metal shops, and welding shops for innovation, creativity, learning, and even university recruitment. The management of these spaces presents unique challenges, particularly regarding safety, access control, and resource allocation. These challenges are magnified when serving a population with large disparities in knowledge sets.

This paper explores the challenges managing these creative environments within educational settings, underscores the risks associated with inadequate access control, and presents GRIT Automation Access Control as a comprehensive solution. By implementing an advanced access control system, educational institutions can enhance safety, efficiency, and cost savings in their makerspaces, woodshops, metal shops, and welding shops.

What's Wrong with Existing Management Practices?

The current management systems in many makerspaces and shops rely heavily on color-coded safety goggles, constant visual confirmation of proper usage by the correct users, anecdotal tracking, and pen-and-paper tracking. These methods can be effective, but are extremely labor-intensive, relying heavily on both staff monitors and the "honor system." These methods also fail to scale to larger shops with more users and tools.

The Dangers of Unregulated Access

Untrained users operating machinery in woodshops, metal shops, welding shops, and makerspaces can lead to a range of issues, from minor injuries to catastrophic accidents. The use of saws, drills, lathes, and other equipment without proper training and supervision increases the likelihood of incidents that can have severe consequences for individuals and institutions alike. Examples of accidents in these settings often include lacerations, amputations, and injuries from flying debris, underscoring the need for rigorous safety protocols and access control measures.

Why Doesn't This Widely Exist Already?

With the obvious dangers and inefficiencies in the existing management procedures, it's an important question: Why Doesn't This Widely Exist Already? The challenges of designing any potential tool-level access control system are manifold. Any such system that could efficiently address these management problems without complicating the underlying issues of user access and safety, must:

- Be simple to install.
- Satisfy a broad range of power requirements, including 120v, 220v, 208v 3PH, and 480 3PH.
- Be configurable to accommodate a wide range of tools, use cases, and access times.

- Be flexible in permissions for individual tools, permission groups, and simultaneous usage to minimize process disruption.
- Be unobtrusive to existing processes and workflow while gathering valuable shop data without additional effort by managers and/or students.

The Solution: GRIT Automation Access Control System

The GRIT Automation Access control system serves as a critical tool in mitigating the risks associated with equipment use in woodshops, metal shops, welding shops, and makerspaces. This system restricts the use of machinery to authorized and trained individuals, ensuring that only those with the necessary skills and knowledge can operate potentially dangerous equipment. Shop administrators can also set access time permissions to control the hours or the minimum number of users present to eliminate late-night solo shop use. By implementing such a system, institutions can significantly reduce the likelihood of accidents, enhance the overall safety of their environments, increase tool longevity, and achieve compliance with safety regulations and standards.

The GRIT Automation system emerges as the only commercial solution that effectively addresses the safety challenges in woodshops, metal shops, welding shops, and makerspaces. It offers a robust and comprehensive access control framework that offers many integration options with existing user databases, providing a scalable and user-friendly solution to enhance safety and reduce the risk of injury.

" I chose **GRIT** so that I could keep students in my shop safe and expand their opportunities for learning more of our tools. The **GRIT** system allows me to focus on those that need the most help instead of worrying about everyone at the same time when the shop is busy. "

Lowell Miller
Fabrication Coordinator
University of Illinois Urbana-Champaign
School of Architecture

" We chose to incorporate **GRIT Automation** in our shop because it provides us with better control over the use of our equipment, data about that equipment usage, and peace of mind knowing that only trained and authorized users are able to turn on a tool. "

Neil Pearse
Lab and Equipment
Operations Manager
University of Illinois Urbana-Champaign
*Siebel Center for Design*

Features of the GRIT Automation System

The GRIT Automation system offers several key features that set it apart as an unparalleled solution for fostering a safety-centric culture in creative and industrial environments:

Tool-Level Access Control

Access Control and Access Times:

GRIT's system restricts access to machinery based on user permissions and training levels, ensuring that only qualified individuals can operate specific equipment, at a specified time, with configurable minimums of signed-in users present.
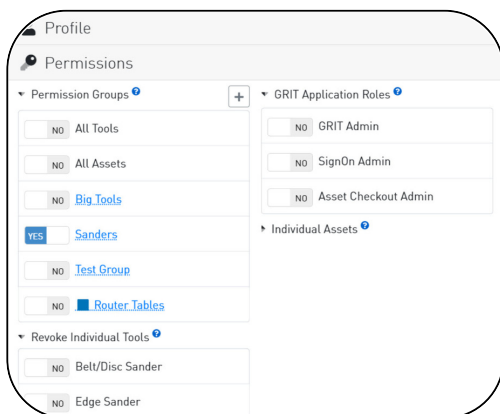
User Accountability:

GRIT tracks usage and maintains records of individual users' activities, fostering a culture of responsibility and accountability that also supports administrators in identifying re-training or disciplinary needs.
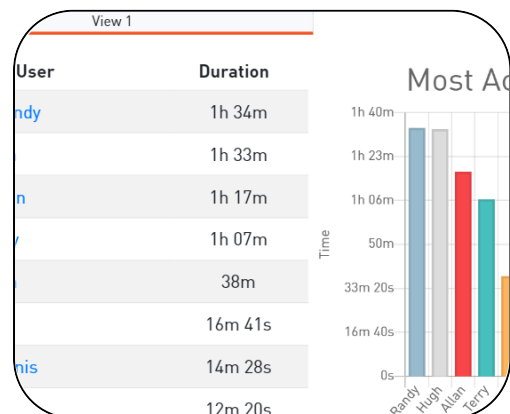
Real-Time Monitoring:

GRIT allows for the real-time monitoring of equipment use, enabling administrators to oversee operations and intervene when necessary.
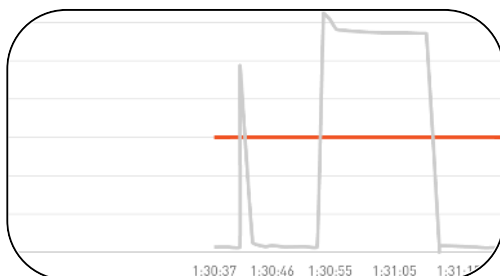
Training and Certification Tracking:

GRIT integrates with LMS platforms to track user qualifications and automatically update access permissions.

Historical Shop Data and Analytics for Cost Savings and Effective Resource Management

Tools, machinery, supplies, and staff are major investments in makerspaces. Shop administrators are tasked with the difficult job of making decisions for the shop without adequate data to guide and justify those decisions. The data that is captured by GRIT enables data-driven purchasing, staffing, inter-departmental billing, and funding request justifications.
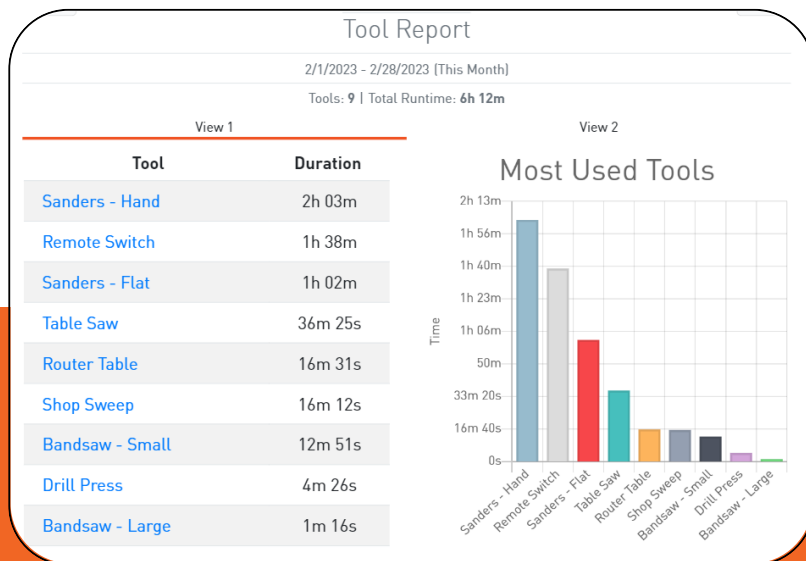
Usage Patterns and Equipment Demand:

By monitoring which tools and equipment are most frequently accessed, administrators can identify high-demand resources. This data helps in prioritizing purchases based on actual usage statistics rather than assumptions, ensuring that investments are made where they are most needed.

Identifying Underutilized Resources:

Data from the GRIT system can reveal which tools are underutilized. This insight allows for reassessment of the need for such tools and may lead to repurposing or replacing them with more relevant equipment.

Preventive Maintenance Scheduling:

The GRIT Maintenance Schedule feature tracks the runtime of each piece of equipment, sends alerts when maintenance tasks are due, and logs when those tasks were performed and by whom. This preemptive approach can extend the life of equipment, leading to cost savings and less downtime.

Tool Report

2/1/2023 – 2/28/2023 (This Month)

Tools: **9** | Total Runtime: **6h 12m**

View 1

Tool	Duration
Sanders - Hand	2h 03m
Remote Switch	1h 38m
Sanders - Flat	1h 02m
Table Saw	36m 25s
Router Table	16m 31s
Shop Sweep	16m 12s
Bandsaw - Small	12m 51s
Drill Press	4m 26s
Bandsaw - Large	1m 16s

View 2

Most Used Tools

(Bar chart with Time axis: 2h 13m, 1h 56m, 1h 40m, 1h 23m, 1h 06m, 50m, 33m 20s, 16m 40s, 0s. Tools: Sanders - Hand, Remote Switch, Sanders - Flat, Table Saw, Router Table, Shop Sweep, Bandsaw - Small, Drill Press, Bandsaw - Large)

Maintenance Schedule   Close

Name

Change Case Oil

Name of the scheduled maintenance task

Description

Unplug Machine
Open Cabinet
Drain Oil
Replace with #15 Lightweight Machine Oil (Shelf 22)
Close Cabinet
Plug in Tool

Description of the scheduled maintenance

Hours of Runtime

100.0 Hours

The number of hours that the tool should operate before the scheduled maintenance

Save

Justification for Staffing

Understanding how and when users access the makerspace allows for more strategic deployment of staff, ensuring that personnel are available for supervision, maintenance, and user assistance when most needed.
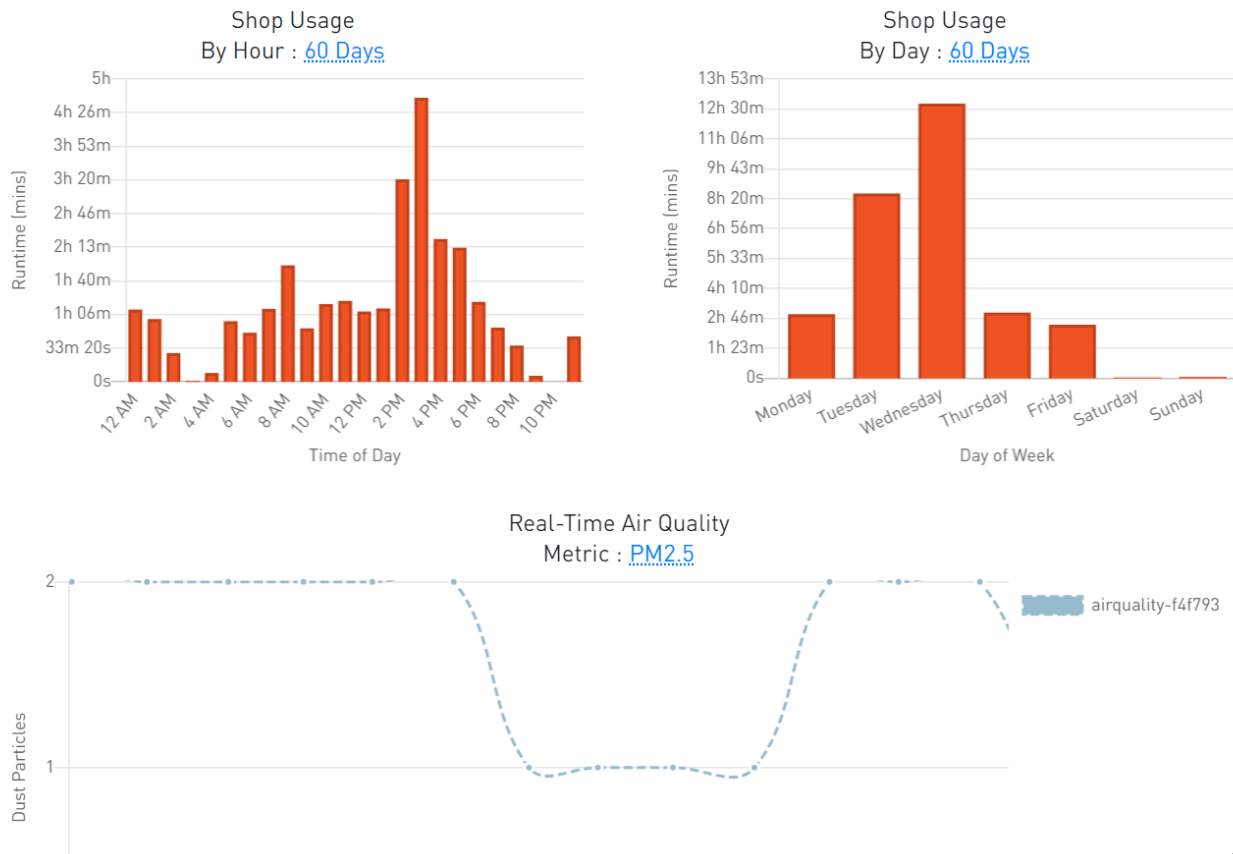
Peak Usage Times:

Analysis of access control data highlights peak usage times, enabling administrators to optimize staffing schedules. Ensuring adequate staffing during high-demand periods enhances safety, improves user experience, and promotes efficient use of the space and budget.

Training and Support Needs:

Data on the most frequently used equipment can also guide decisions on where to focus staff training and user support efforts. Staff can be trained specifically on popular or complex equipment to better assist users, improving safety and operational efficiency.

Assets Checked Out: 1 | No Maintenance Required

Shop Usage By Hour : 60 Days

Shop Usage By Day : 60 Days

Real-Time Air Quality Metric : PM2.5

airquality-f4f793

Program Expansion and Inclusivity Evaluation

Data captured by the GRIT Automation system can also be used for institutions which are evaluated by ABET standards for accreditation. ABET documents that "modern tools, equipment, computing resources, and laboratories appropriate to the program [are] available, accessible, and systematically maintained and upgraded to enable students to attain the student outcomes and to support program needs." [ABET, general criterion]

Additionally, the ability to collect and analyze data within a makerspace can facilitate future research and program development, creating a quantifiable basis upon which to promote institutional change through grants, workshops, training, and conferences.

Trend Analysis for Expansion:

Longitudinal data from the GRIT system can reveal trends in usage over time, informing decisions about program expansion. For example, consistent increases in the use of certain types of equipment or tools can justify the expansion of those areas or the introduction of new technologies.

Evidence-Based Proposals:

When seeking funding or support for expansion, data from GRIT can provide compelling evidence of need and potential impact. This data strengthens grant applications and funding proposals, showing a clear demand for expanded resources or services.

User Engagement and Inclusivity:

By examining usage and user demographics, administrators can gain insights into the efficacy of certain initiatives aimed at the people the space is meant to serve, guiding the development of new programs or the expansion of existing ones.

Case Studies: The Impact of GRIT Automation

Many makerspaces and shops have successfully implemented the GRIT Automation system, resulting in dramatic improvements in safety, accountability, and efficiency. For the following case studies, GRIT has either greatly improved the issue or could have mitigated it had it been implemented.

Case study #1:
University of Illinois

Inability to provide extensive instruction

Prior to installing the first GRIT Automation system in a university shop, Architecture Fabrication Shop Manager, Lowell Miller, was not able to sufficiently ensure that students used tools that they were trained to use. He wanted to spend less time policing and more time teaching. Miller now reports that he is able to provide better instruction and uses GRIT Automation as a recruitment tool for prospective students and their parents.

Case Study #2:
University of Illinois

Inability to accurately bill for shop usage

Prior to installing GRIT, the Sidney Lu MEB Metal Shop used pen-and-paper, "honor system" reports to track machine usage times for billing across multiple funding sources. With GRIT, the shop manager now exports an accurate monthly report to their billing department. This saves time and money.

Case Study #3:
Yale University

Student death

In 2011, an undergraduate student died after her hair was caught in a lathe while working alone in a university lab late at night.

GRIT Automation has features that allow for access times and minimum number of signed-in users to allow tool operation, avoiding the hazards that come from late-night, solo tool use.

Case Study #4:
Champaign Central High School

Student limb partial-amputation

In 1996, a high-school senior who spent his days with a one-on-one teacher's aid was cutting a piece of wood on a table saw during shop class. His usual teacher's aid was not present and his substitute teacher was up at the front of the class. His wood became bound, he pushed harder, and the blade pulled his arm through, severing it.

With GRIT Automation Access Control, he would not have been able to power on the saw without the presence of his aid. Update: Champaign Central High School recently installed GRIT Automation.

Conclusion

The integration of woodshops, metal shops, welding shops, and makerspaces into the educational curriculum represents a significant advancement in experiential learning. The effective management of these spaces is crucial to ensuring their safe and productive use. GRIT Automation Access Control presents an innovative solution that addresses the core challenges of safety, security, and resource management. By implementing such a system, institutions can safeguard their students and staff, optimize the utilization of resources, and maintain an environment that nurtures creativity and innovation for all.