

AUTOMATED LOCKER USER MANUAL

BY

ALEX KIM, REDWAN IBNE SERAJ KHAN,
HANG LIN, JAY CHEN, WEIJIN ZHU,
KEVIN CHEUNG, KEMING KUANG,
HUANGWEI DING

*School of Engineering and Applied Sciences
University at Buffalo, The State University of New York*



FIGURE 1: OVERVIEW OF AUTOMATED LOCKER

Contents

1	Introduction	2
2	Overview of System	2
2.1	System Descriptions	2
2.2	System Components	2
3	Using the Locker	5
3.1	Turning on the Locker	5
3.2	Unlocking the Locker	5
3.3	Locking the Locker	5
3.4	Mechanical Key Override	6
3.5	Charging the Battery	7
3.6	Modifications Made to the Locker	8
3.7	User Required Maintenance	8
4	Ordering Additional RFID Tags	8
5	Troubleshooting	8
6	Safety & Caution Statements	8

1 Introduction

2 Overview of System

2.1 System Descriptions

We have modified a locker from Depew High School in Depew, NY 14043. We modified it with an electronic system that replaces the old locking mechanism. The system allows a user to unlock the door by scanning a pre-registered RFID (Radio-Frequency Identification) tag. After 5 seconds of being unlocked, the locking mechanism automatically locks again.

Even if the locking mechanism has already locked while the door is open, the door can be closed by simply pushing it to the frame. In case of system failure (e.g., dead battery or switch malfunction), we have also implemented a mechanical key override, which can be used to open and close the door manually.

2.2 System Components

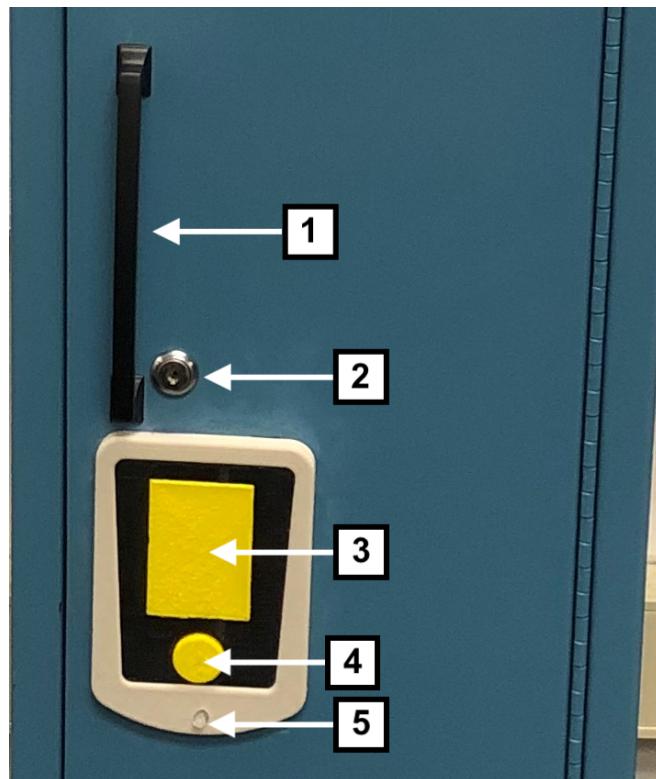


Figure 2: Front View of Automated Locker

- 1. Door Handle
- 2. Mechanical Key Override
- 3. RFID Tag Reader
- 4. Power Button
- 5. LED Indicator

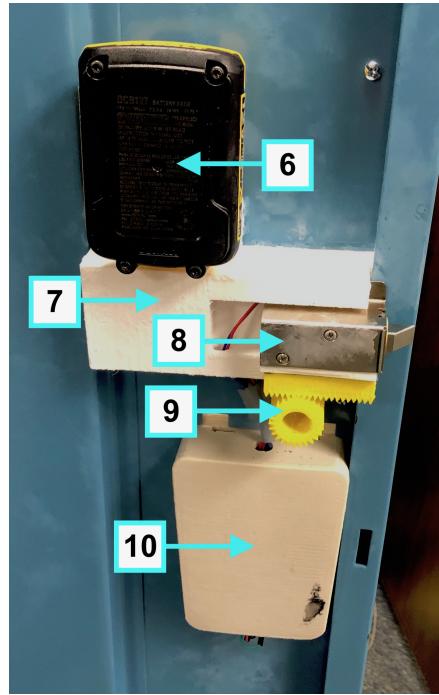


Figure 3: Rear View of Automated Locker

- 6. Battery
- 7. Lock Frame
- 8. Lock
- 9. Sliding Mechanism
- 10. Hardware Frame (RFID Tag Reader with Arduino & Power Button)

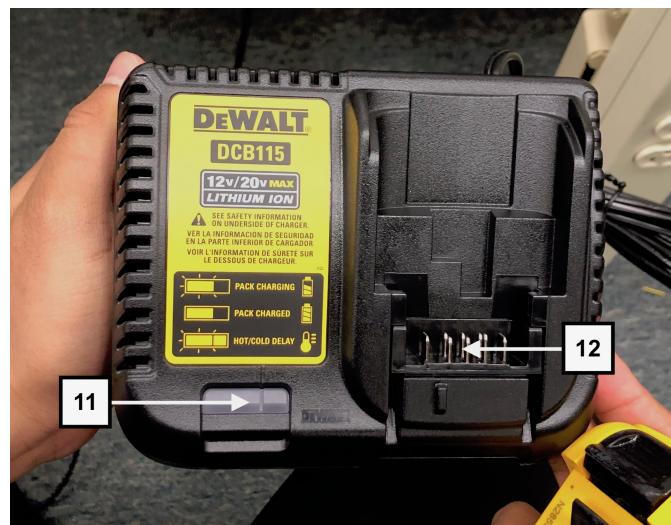


Figure 4: Battery cradle (Located Inside Locker)

- 11. Battery Cradle
- 12. Battery Connectors



Figure 5: RFID Key Tag



Figure 6: Mechanical Override Key



Figure 7. Dewalt Battery Charger



Figure 8. Dewalt Rechargeable 12V Battery

3 Using the Locker

3.1 Turning on the Locker

The system is powered by Dewalt Rechargeable 12V battery that resides inside the locker. Pressing the large round yellow power button (Figure 2, item 4) on the front of the locker door turns on the system. Then, LED light (Figure 2, item 5) will turn on as red, indicating the system has been turned on, but the door is locked.



Figure 9: Pressing Power Button



Figure 10: LED Light Turns On

3.2 Unlocking the Locker

The user has to place the RFID Tag in front of the reader (Figure 2, item 2). After successful attempt, the LED light will turn green, signaling the locker has been unlocked. The user needs to pull off the door slightly using the door handle (Figure 2, item 1). The system will time out and locks automatically after 5 seconds of inactivity.

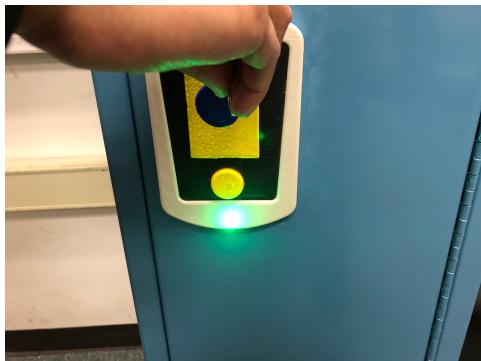


Figure 11: Scan Successful



Figure 12: Opening the unlocked door

3.3 Locking the Locker

After 5 seconds of opening the lock, if the user didn't pull the door, the locker will automatically get locked again. If the user has opened the door within 5 seconds, and wishes to close it again, he just need to press the door against the frame and the locker will get locked again.

3.4 Mechanical Key Override

If there's any power failure of Dewalt Rechargeable 12v Battery, the user can use an external override key (Figure 6) to unlock the locker. The key needs to be inserted in the lock (Figure 2, item 2) and it has to be turned right to unlock, and pull off the door handle (Figure 2, item 1). After the door has been opened, the user has to turn the key to the left to place the locker in the right position and push the door to lock it completely.



Figure 13: Inserting the Key



Figure 14: Unlocking the lock



Figure 15. Opening the unlocked door

3.5 Charging the Battery

Confirm that the system is powered off before changing the battery. Hold the battery firmly and lift it off slightly from the Locker Frame (Figure 3, item 7). Then, take the battery and place it on the Dewalt Battery Charger (Figure 4), so that the pins in the cradle (Figure 4, item 12) go into the grooves of the battery. Plug in the charger to power outlet and see whether the light indicator (Figure 4, item 11) turns red.



Figure 16: Pulling Off the Battery



Figure 17: Removal of the Battery



Figure 18: Dewalt Battery Charger



Figure 19: Plugging Battery into the Cradle



Figure 20. Light Indicator Turned Red

3.6 Modifications Made to the Locker

Please refer to the design documentation for modifications and part specifications.

3.7 User Required Maintenance

The system requires users to charge the battery often and keep the RFID tags in a secure place. For more details about charging the battery or replacing the dead battery, please refer to the 'Charging the Battery' section. If the battery is dead while the door is locked, refer to 'Mechanical Key Override' section. If there's any damage to any component, please refer to the design documentation for more parts details.

4 Ordering Additional RFID Tags

Please use the link below to order more RFID tags from Amazon. You'll need expert support to program your purchased RFID tags to be used with the automated locker. In that case, the expert needs to look into the design documentation.

<https://www.amazon.com/Smart-Keyfobs-Keychain-Mifare-Arduino/dp/B01N06OLMJ>

5 Troubleshooting

If the LED light (Figure 2, item 5) doesn't light up after pressing the power button (Figure 2, item 4), try to press it a few more times with a little more force and see if it lights up. If it doesn't light up, there's high possibility that the battery is dead. Therefore, charge the dead battery. If it doesn't work after that, it probably means that there's a damage to the internal electronics. In that case, the user needs to use the mechanical override key (Figure 6) to access the inside of the locker.

6 Safety & Caution Statements

PRODUCT SAFETY NOTICE: If the substitute replacement component does not meet with the same properties as the recommended replacement one, shown in the parts list in the Design Documentation, it may result shock, fire, or other hazards. User might get electrocuted if any liquid gets inside the charger. User should never use wet hands while operating on the locker. If the component gets wet, do not use the system until it's completely dry. User must only use approved Dewalt Battery of the exact model number listed in the Design Documentation with the provided Dewalt Battery Charger only. Use of any other models might result in personal injury and damage. Refrain from misplacing the locker frame in any way. Do NOT attempt to make any modifications or changes without consulting a trained expert.