



UCF Senior Design 1: Study Buddy

Divide & Conquer 2.0

Dr. Lei Wei

Dr. Samuel Richie

Department of Electrical Engineering and Computer Science

Group 33:

Cliff Porter	Computer Engineering
Kaiden Duvall	Computer Engineering
Denzel Stockhausen	Electrical Engineering
Idris Al-Shidhani	Electrical Engineering

Project Narrative:

Among the many problems that students face, one of the most obvious and personally impactful to each is the presence of distractions that can pull attention away from their studies. This issue has been exacerbated in the modern age, with many students having easy access to handheld devices, such as smartphones, that serve as a tempting distraction from their work. While many may consider this a problem relating purely to the discipline of individuals, it seems certain that isolation from easy distractions coincides with an increase in productivity.

Currently, only a few devices exist on the market to solve this exact problem. The most popular variation of this is a timed smart phone lock box designed to hold phones of a certain size in place until the end of a timer set by the user. This is primarily intended as a self-discipline tool, but can also be used as a parental control device. The fact that this device is targeted at removing phones specifically as a distraction means that it can only lock away phones and very similarly shaped objects.

We intend to design an easy to use device that can temporarily store distracting objects away in a locked container with multiple compartments. The device will be unlockable either by setting a timer when locking that will automatically unlock a compartment, or through several access methods such as a keypad, a fingerprint scanner, or an RFID scanner, all built into the device and configurable via a display. Anyone placing their phone into a compartment on the device will be able to charge it via a built-in USB port. This “Study Buddy” will also contain lid sensors that will detect if the container has been opened forcefully or prematurely and log the time of access to display to the owner of the device.

In addition, the Study Buddy will have a remote that can be used to wirelessly view the timer and locking/unlocking conditions in a short range, as well as notifying the user when the main container (the “locker”) is unlocked or opened. This will make parental control easier, and also allow for the locker to be in a different room while the user studies. The remote will be battery operated to allow it to be easily taken with the device’s owner.

The intended customer base for this product is parents, who may use the Study Buddy as a parental control tool to help ensure their child is studying, or to enforce device limitations on phones and gaming systems. An additional customer base is highschool and college age students who could use the Study Buddy as a self-discipline tool to keep their phones and other devices out of reach and promote a more efficient studying environment.

Requirements:

Table 1 shows the requirement specifications of the Study Buddy and the Study Buddy remote.

Table 1: Project Requirements

Feature	Feature Description	Units
Basic Requirements		
Empty weight	Be easy to carry	≤ 10 lbs
Carry capacity	Hold a decent amount of weight without damage	≥ 15 lbs
Large storage locker size	Store a standard 15in laptop	$\geq (16\text{in} \times 12\text{in} \times 2\text{in})$
Smaller storage lockers size	Store phones or gaming controllers.	$\geq (10\text{in} \times 4\text{in} \times 6\text{in})$
Locker battery life	Run without external power for the specified time	≥ 2 hours
Remote battery life	Run for the specified time	≥ 7 days
External power efficiency	Run off and charge batteries from standard wall AC power (120V AC 60Hz \pm 5%)	$\geq 85\%$ conversion efficiency
Wireless range	Distance the remote and locker can remain connected	20 feet
Tamper detection	Detect unauthorized opening of compartments and provide a means for the owner to be notified	90% reliability
Wireless latency	Updates between the remote and locker	≤ 400 ms
Security	Users can access device configuration on the locker via keypad PIN number, and RFID scanner.	90% - 100% reliability
Advanced features		
Wireless range	Distance the remote and locker can remain connected	50 feet
Power for phone chargers	Include 3 USB ports for phone charging	Three 5V 2A USB A ports
Advanced security	Users can access device configuration on the locker via fingerprint access.	80% reliability
Stretch goals		
Emergency override	Detect when a user might need emergency access to their phone and unlock	65% reliability


 - Demonstrable specifications

Table 2: House of Quality

		<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↑</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>↓</td><td></td> </tr> </table>														↓								↓									↑									↓									↓									↓									↓									↓									↓									↓									↓									↓									↓									↓									↓									↓									↓	
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↑																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
							↓																																																																																																																																																									
		Column #																																																																																																																																																														
		1	2	3	4	5	6	7																																																																																																																																																								
		Direction of Improvement																																																																																																																																																														
		▼	▲	▼	▼	▲	▲	▲																																																																																																																																																								
Row #	Direction of Improvement	Engineering Requirements	Cost	Sensor reliability	Dimensions	Weight	Remote battery life	Power efficiency	Wireless range																																																																																																																																																							
		Customer Requirements																																																																																																																																																														
1	▼	Cost	↑↑	↓	↑	↑	↓	↓	↓																																																																																																																																																							
2	▲	Ease of use		↑↑	↓	↓	↑		↑↑																																																																																																																																																							
3	▲	Security	↑↑	↑																																																																																																																																																												
4	▲	Portability			↑↑	↑↑			↑↑																																																																																																																																																							
5	▲	Storage space	↓		↑↑	↓																																																																																																																																																										
6	▲	Battery life	↓			↑	↑↑	↑↑	↓																																																																																																																																																							
7	▲	Remote functionality	↓	↑↑			↑↑		↑↑																																																																																																																																																							
		Target for Engineering Requirements	≈250\$	> 80%	> (16in x 12in x 2in)	< 10 lbs	≈ 7 days	> 80%	≈ 20 ft																																																																																																																																																							

Project Block Diagrams:

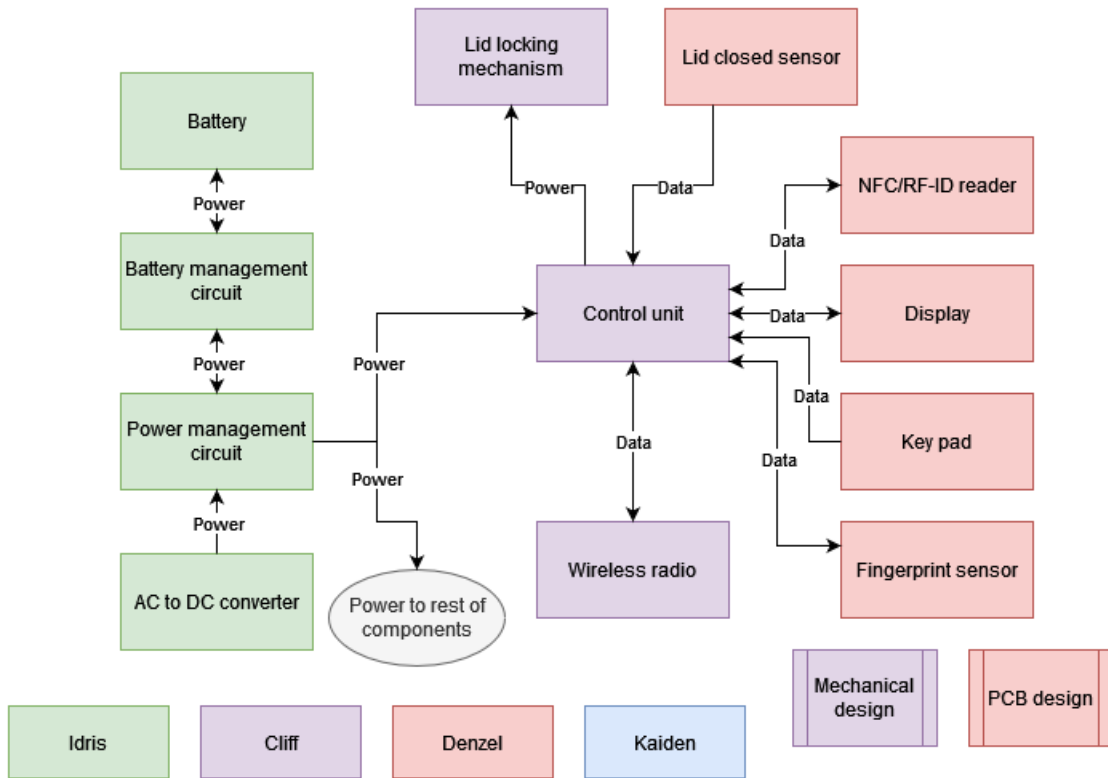


Figure 1: Locker / Study Buddy Hardware Block Diagram

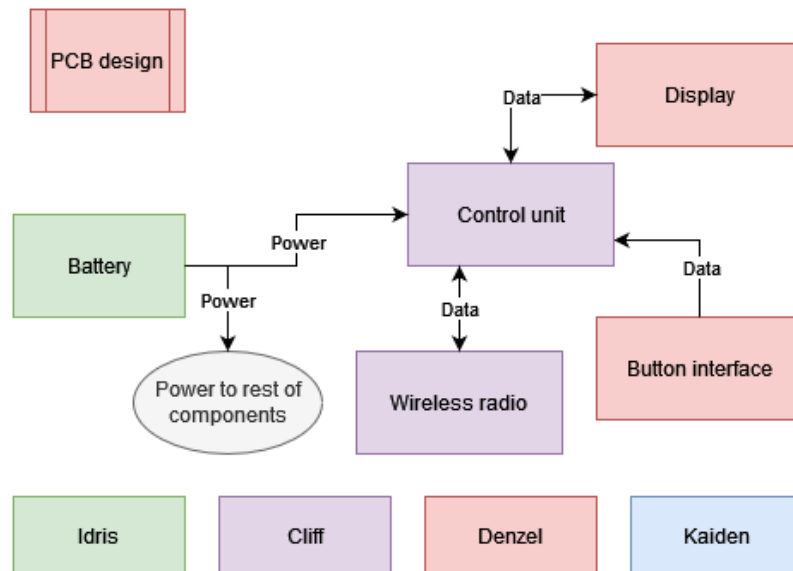


Figure 2: Study Buddy Remote Hardware Block Diagram

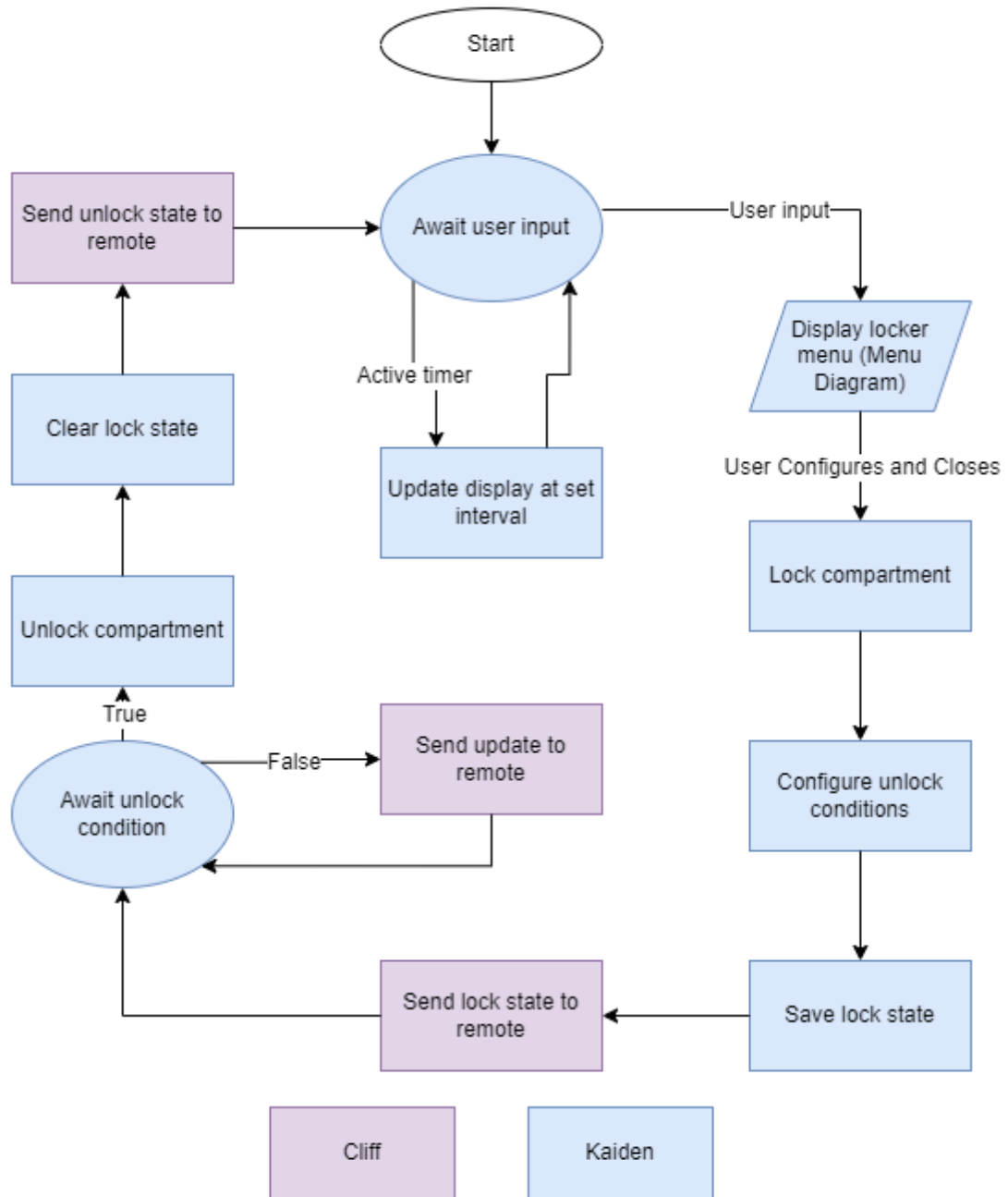


Figure 3: Locker / Study Buddy Software Block Diagram

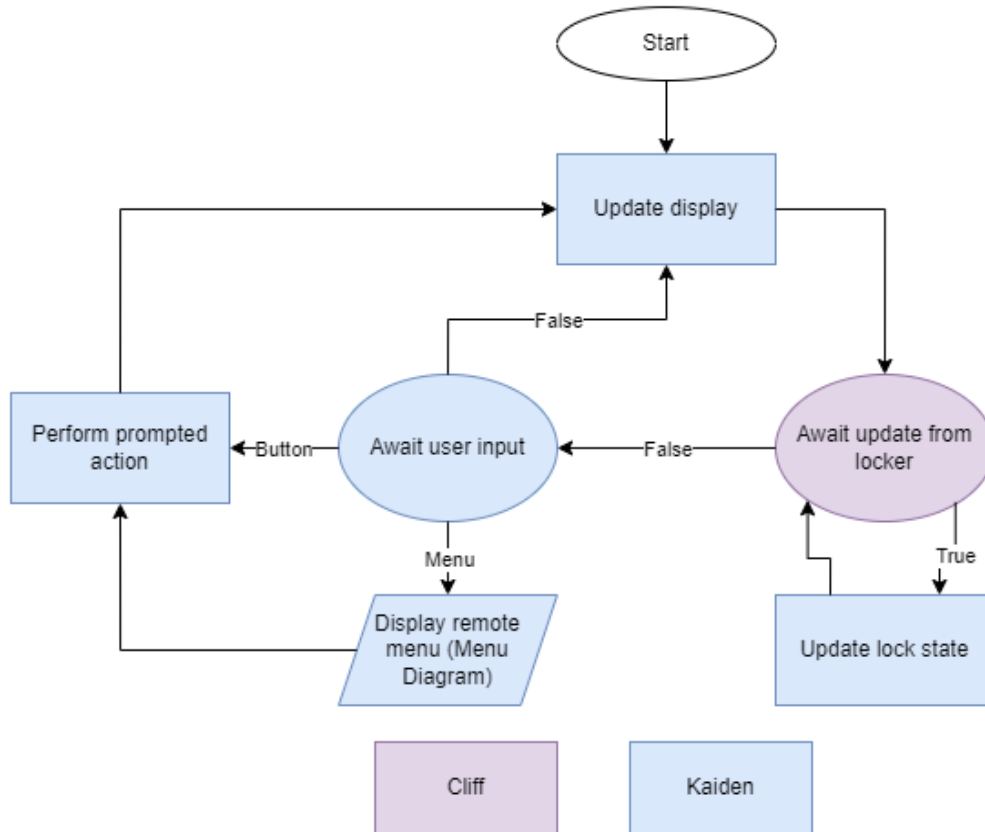


Figure 4: Study Buddy Remote Software Block Diagram

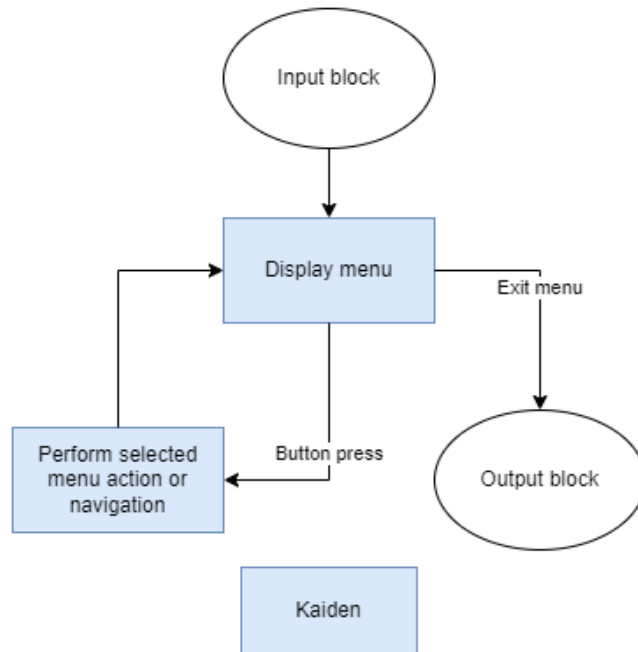


Figure 5: Menu Block Diagram

Prototype Mock-up:

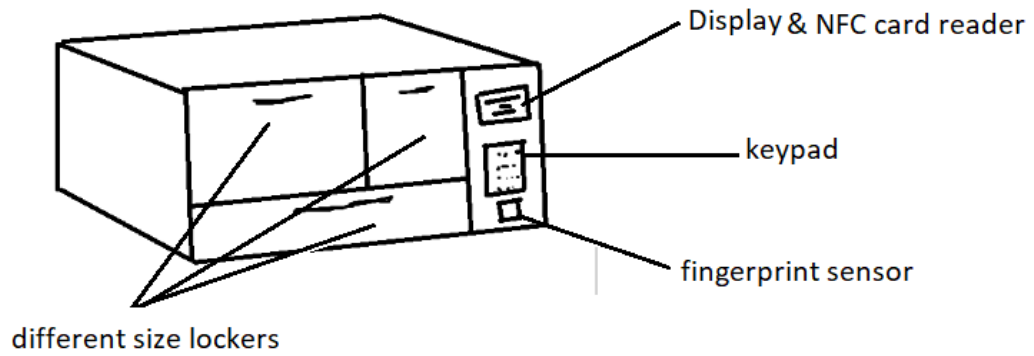


Figure 6: Mockup of the Locker / Study Buddy

Project Budget and Financing:

Table 3: Estimated Cost of Project Materials

Component	Quantity	Estimated cost
Keypad	1	\$ 5.00
Large display	1	\$ 11.00
Small display	1	\$ 1.50
Fingerprint sensor	1	\$ 20.00
NFC reader	1	\$ 12.00
NFC tags	4	\$ 5.00
Rechargeable batteries	3	\$ 9.00
Remote battery	1	\$ 1.00
Wall wart	1	\$ 7.00
Locks	3	\$ 13.00
Small motors	3	\$ 7.00
Lid sensors	3	\$ 3.00
Radio modules	2	\$ 7.00
Controller chips (MCU)	2	\$ 1.60
Push buttons (multi pack)	1	\$ 13.00
PCB (main)	1	\$ 15.00
PCB (remote)	1	\$ 15.00
Construction material	1	\$ 12.00
Total		~\$ 250.00

We will be financing our project by splitting the cost evenly amongst ourselves.

Initial project milestone for both semesters:*Table 4: Estimated Timeline and Milestones*

Number	Milestone	Planned Completion week (SD1 & SD2)
1	Project selection and role assignment	Week 1 & 2
2	Project proposal - Divide and Conquer V1	Week 3 & 4
3	Research and initial design	Week 5 & 6
4	Updated Divide & Conquer V2	Week 5 & 6
5	Continuing design and 60 page draft Senior Design I documentation	Week 7 - Week 11
6	100 page report submission updated	Week 12 - Week 13
7	Purchasing and testing parts	Week 17- Week 18
8	Developing code	Week 19 - Week 20
9	Designing, ordering and testing PCBs	Week 21 - Week 24
10	Redesigning and ordering final versions of PCBs	Week 25 - Week 27
11	Final document and presentation	Week 28 - END