DOVICO™
SOFTWARE

Time Tracking Fridge

Parts and Assembly Instructions

January 19, 2015

The Basic Operation

An Android app monitors your hosted Dovico database for a specific number/percent of submitted time for the week. Example: Unlock the refrigerator when the submitted time reaches 90% of the weekly total. A microcontroller circuit continuously monitors this app for that trigger sign. Once received, the microcontroller sends a signal to release the magnetic lock attached to the refrigerator.

Summary

This document describes the components and how to put them together to build your own time tracking fridge. There are many ways to build your fridge, but the parts used and methods described here are based upon our budget and the skillsets available at Dovico (electronics and software development).

There are 3 custom parts. First is the base enclosure used to mount the magnetic lock assembly and to house many of the electronic components. Second is a bracket to mount the other half of the magnetic lock (the armature plate) to the refrigerator.

The 3rd custom part is the software/firmware for the Android device and the microcontroller. However, we will send you our Android app and the microcontroller code under one condition; that you send us photos of your time tracking fridge when it's done. If you send us a video that we can post, then we'll help you stock your refrigerator the first time. Just call your Dovico sales representative to get the process rolling.
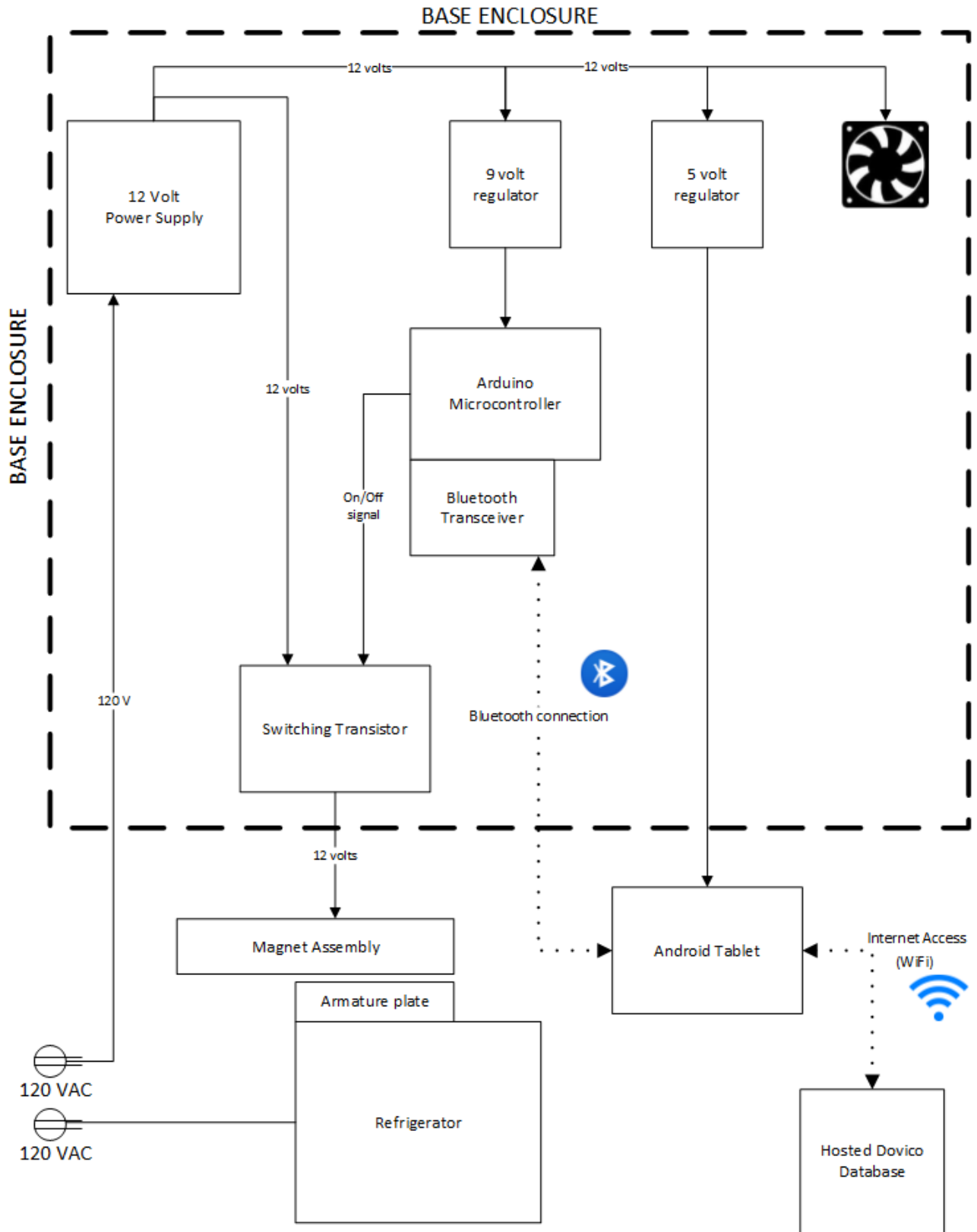
All other parts you can purchase. We sourced our parts mostly through eBay. Although many can be purchased from your local electronic parts store (Radio Shack). See Appendix A for the list of parts. Excluding the cost of the refrigerator and the Android device (tablet or smartphone), these parts will cost you approximately $200 to $250 dollars.
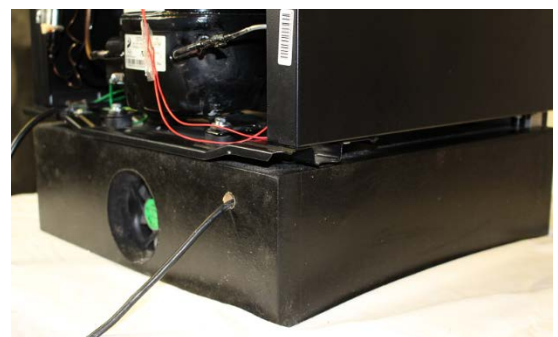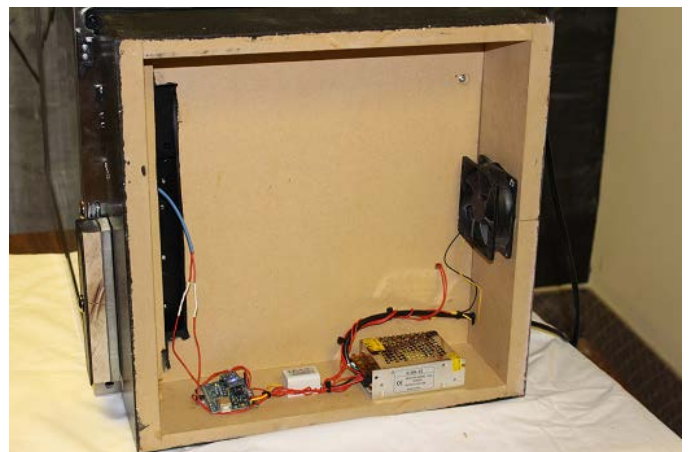
We're not providing detailed wiring diagrams. So you will need someone who can read component data sheets and to connect all the wires, some of which are 120 volts. Because of these factors, that person should be someone with a background in electronics.

The next page contains a basic diagram of the parts and their connections. The pages that follow provide a few more details and tips on the assembly.

Cheers

COMPONENT DIAGRAM

BASE ENCLOSURE

BASE ENCLOSURE

12 volts — 12 volts

| 12 Volt Power Supply | 9 volt regulator | 5 volt regulator |

Arduino Microcontroller

Bluetooth Transceiver

12 volts

On/Off signal

120 V

Switching Transistor

Bluetooth connection

12 volts

Magnet Assembly

Armature plate

Android Tablet

Internet Access (WiFi)

120 VAC

120 VAC

Refrigerator

Hosted Dovico Database

Miscellaneous photos of the completed time tracking fridge

Magnetic lock

The magnetic lock is a simple 2 component system. (1) The magnet assembly, which is turned on/off by a microcontroller, is attached to the custom base enclosure. (2) The armature plate, which is attached to the refrigerator door, is attracted to the magnet assembly when the magnet is energized. How you mount each component will depend on your refrigerator. We chose to mount it to the bottom because the refrigerator is a small bar fridge and it is a bit more esthetically pleasing.
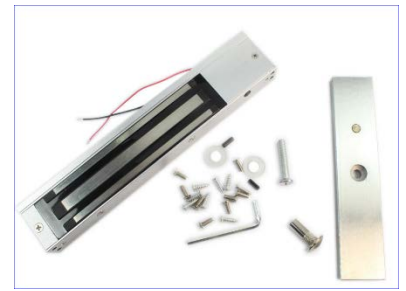
You could use an electro-mechanical lock assembly instead of a magnetic one.
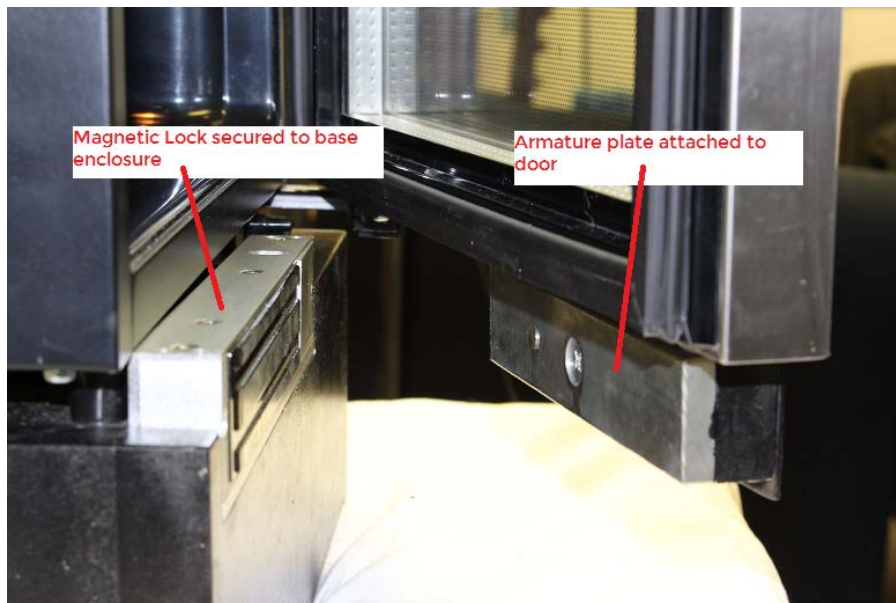
*When the magnet is turned on, the armature plate is pulled towards the magnet.*
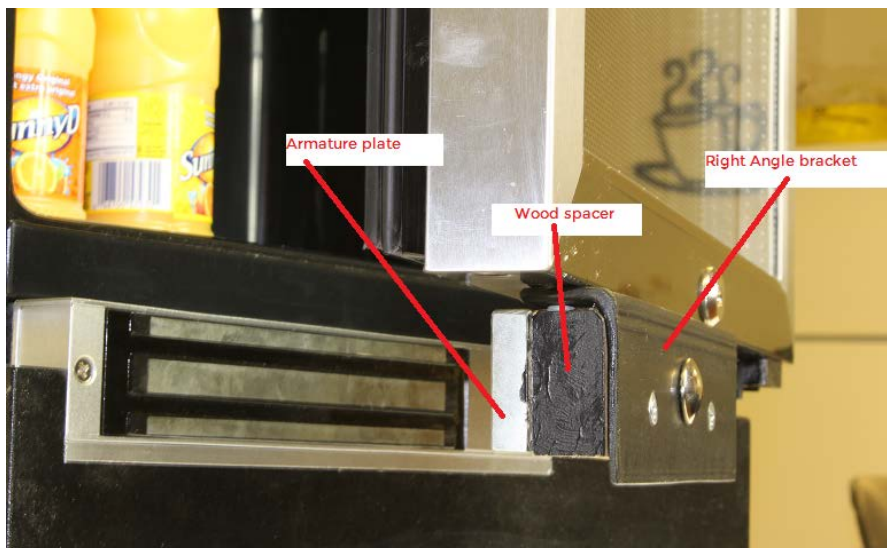
We locally sourced a right angle bracket to attach the armature plate to the door. A wooden spacer was added to bring the armature plate as close as possible to the magnet when the door is closed.
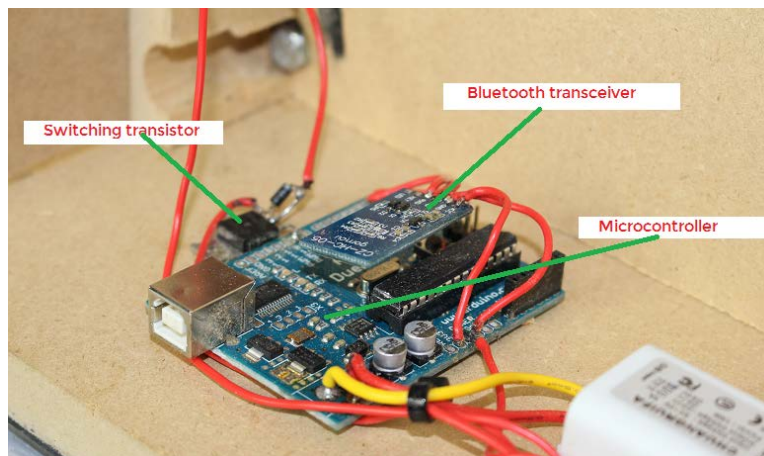
Microcontroller and Bluetooth transceiver

The microcontroller and transceiver assembly has two jobs: (1) It controls whether the magnetic lock is energized (locked) or not, and (2) it communicates with the Android app to check if the trigger target level has been reached. The communications with the Android app is done using a Bluetooth transceiver module that connects to the microcontroller. The Bluetooth transceiver has to be hand wired to the microcontroller.

If you chose the same Arduino microcontroller that we bought (Arduino Uno R3), we can offer you all the code we wrote to make it work. http://arduino.cc/en/Main/ArduinoBoardUno
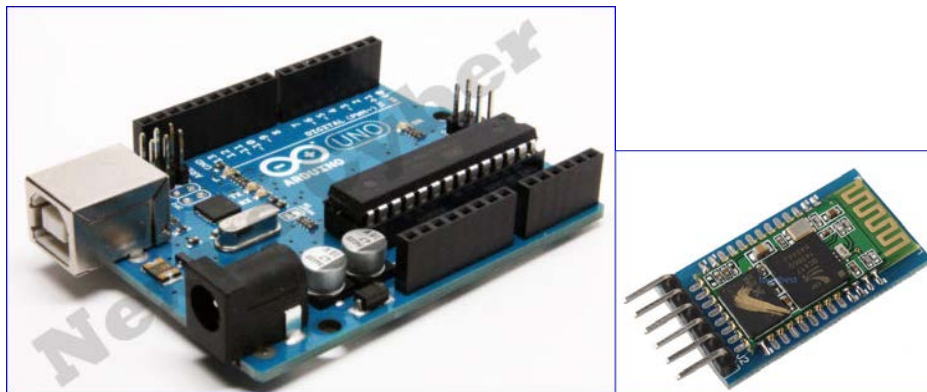
Microcontroller   *Bluetooth transceiver*

Microcontroller and transceiver assembly

Power Supply

All you need is a 12 volt power supply. It supplies dc power to the
magnetic lock. It also powers, via voltage regulators described next,
the microcontroller (9 volt) and Android tablet (5v). None of these
use a whole lot of current, so 120W supply is plenty of power.

We could have used the Android tablet's own power cable, but we
didn't want to have too many cables coming out of the unit. Our design requires only 2 power
outlets: one for the refrigerator and one for the power supply.

Voltage regulators (5v and 9v)

Use 2 different voltage regulators. A 9 volt regulator that powers the
Arduino microcontroller and a 5 volt regulator that powers the Android
tablet. **NOTE**: If your power supply also has a 5 volt output, you can use
it to power the tablet instead of a 5 volt regulator.

Switching Transistor and Diode

A NPN switching transistor is used to control the 12 volt signal to the magnetic lock. The diode
(1N4001) is used to prevent back voltage from damaging the electronics when power is removed.
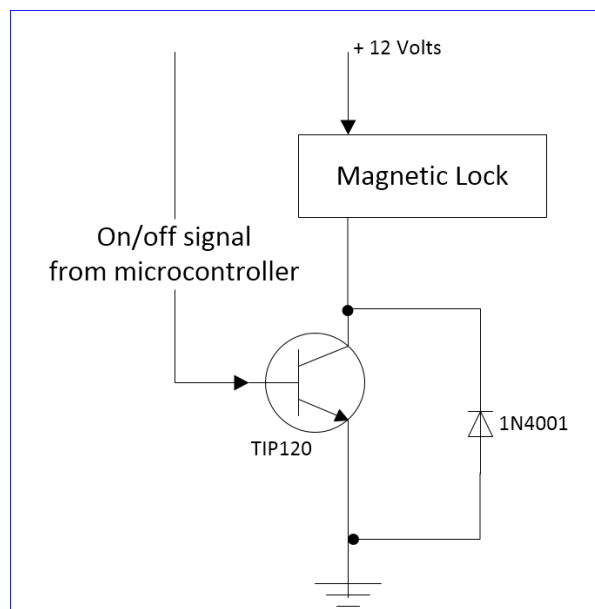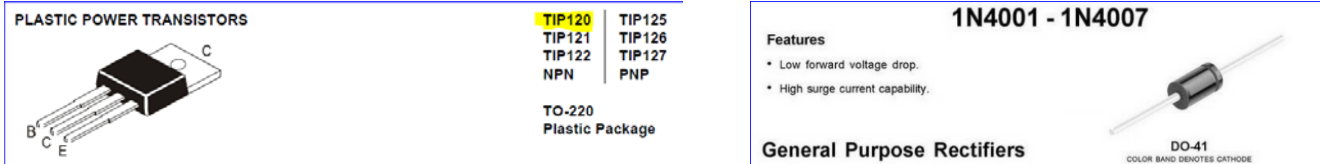
Switching transistor and diode wiring diagram

Ventilation Fan

Because our electronics are completely enclosed, we chose to drill a hole through the back of the base enclosure to add a 12 volt exhaust fan.

Refrigerator – considerations

Try to determine where the fridge will be positioned so you can get the door hinged on the correct side. Ideally, the magnetic lock and armature plate would be placed close to the refrigerator's handle. This is especially important on a full sized refrigerator. However this may require you to drill holes in your refrigerator's body. Dovico's refrigerator is a small bar fridge, so we were able to get away with placing the magnetic lock assembly at the bottom.

Base enclosure

The base enclosure contains the power supply, voltage regulator, microcontroller, etc. Depending on the size of your enclosure and the air flow around it, you will probably want to include some ventilation holes/slots or a fan. We added an exhaust fan. Our enclosure is made of wood which also doubles as a base for the refrigerator.
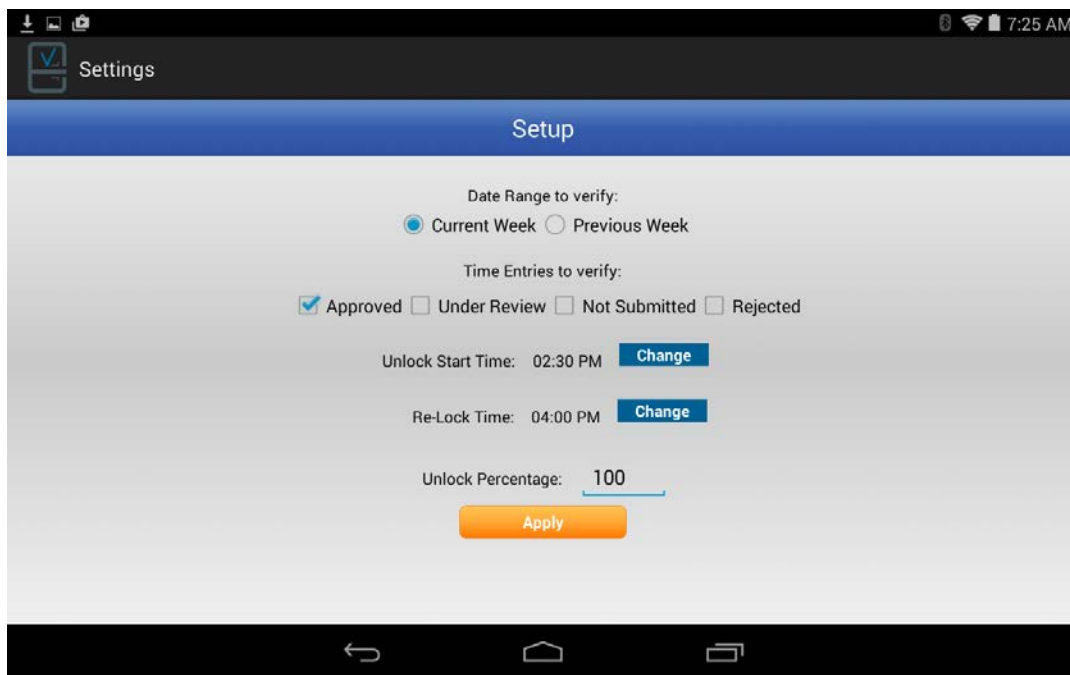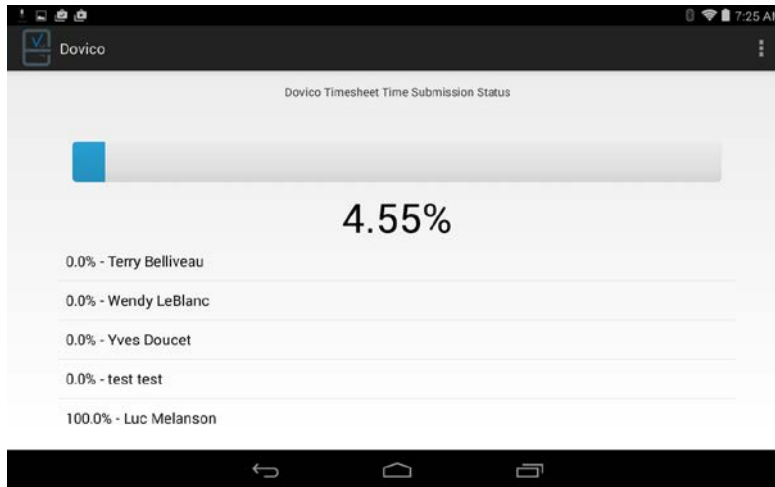

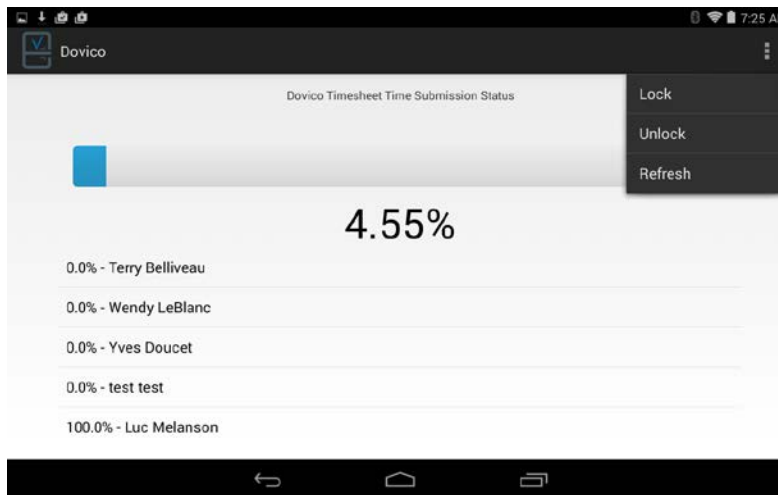*Close up of magnet and armature with door closed*
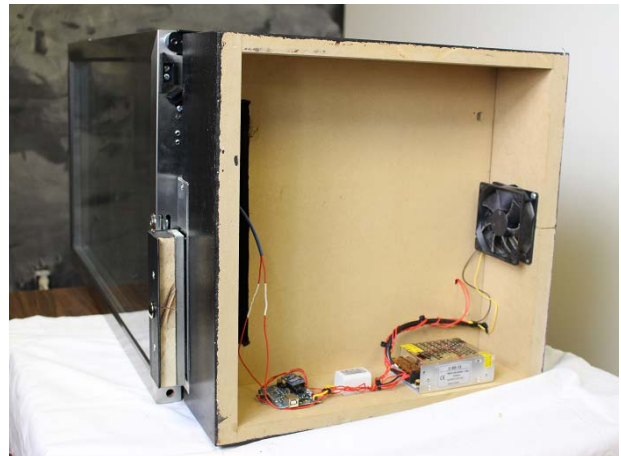
Android device

The Android device can be a smartphone or tablet. We chose to use a tablet and mount it to the refrigerator so everyone could monitor the target's progress during the week. Any Android device will suffice as long as it has Bluetooth capability.

App setup

Main Screen

Main screen with Manual Lock/Unlock

If you choose to mount your tablet to the refrigerator, you will need to find a bracket for your device. The piece of transparent plastic you see in the photo below was attached because the refrigerator's painted surface was not smooth enough for the suction cups to work properly.

Tablet mounting bracket

Appendix A

Off the shelf parts

Magnetic Lock:

http://www.ebay.ca/itm/New-280Kg-Holding-Force-Home-Security-Single-Door-Magnetic-Lock-DC-12V-/251673403263?pt=LH_DefaultDomain_0&hash=item3a98e75f7f

Arduino Microcontroller: Arduino Uno R3

http://www.ebay.ca/itm/Genuine-Arduino-Uno-R3-ATMEGA328P-ATMEGA16U2-Authorized-US-Reseller-/290912921568?pt=LH_DefaultDomain_0&hash=item43bbc2e7e0

Bluetooth module:

http://www.ebay.ca/itm/301154452287?ru=http%3A%2F%2Fwww.ebay.ca%2Fsch%2Fi.html%3F_from%3DR40%26_sacat%3D0%26_nkw%3D301154452287%26_rdc%3D1

The following parts (or their equivalents) can likely also be purchased from your local Radio Shack or The Source stores.

Power Supply:

http://www.ebay.ca/itm/7-Port-HH-Power-Supply-Box-120W-12V10A-Power-Supply-Box-/300570348778?pt=LH_DefaultDomain_0&hash=item45fb638cea

Transistor:

http://www.ebay.ca/itm/251525068084?ru=http%3A%2F%2Fwww.ebay.ca%2Fsch%2Fi.html%3F_from%3DR40%26_sacat%3D0%26_nkw%3D251525068084%26_rdc%3D1

Step down converter 12V to 9V:

http://www.ebay.ca/itm/261476230448?ru=http%3A%2F%2Fwww.ebay.ca%2Fsch%2Fi.html%3F_from%3DR40%26_sacat%3D0%26_nkw%3D261476230448%26_rdc%3D1

Step down converter 12V to 5V:

http://www.ebay.ca/itm/Waterproof-DC-DC-Converter-12V-Step-Down-to-5V-Power-Supply-Module-3A-15W-WHITE-/231390766479?pt=LH_DefaultDomain_0&hash=item35dff6e58f

12 Volt fan

http://www.ebay.ca/itm/New-120mm-4Pins-12V-PC-CPU-Host-Chassis-Computer-Case-IDE-Fan-Cooling-Cooler-/231412668467?pt=US_Computer_Case_Fans&hash=item35e1451833

1N4001 Diode

http://www.ebay.ca/itm/20-pcs-Diodes-GP-50V-1A-175-C-1N4001-/290571444188?pt=LH_DefaultDomain_210&hash=item43a7685fdc