

# Automatic Handshake Contact Information Exchanger

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# OVERVIEW

- Introduction & Key Features
- Design & PCB Revisions
- Requirements & Verification
- Project Build
- Successes & Challenges
- Failed Verifications
- Future Work

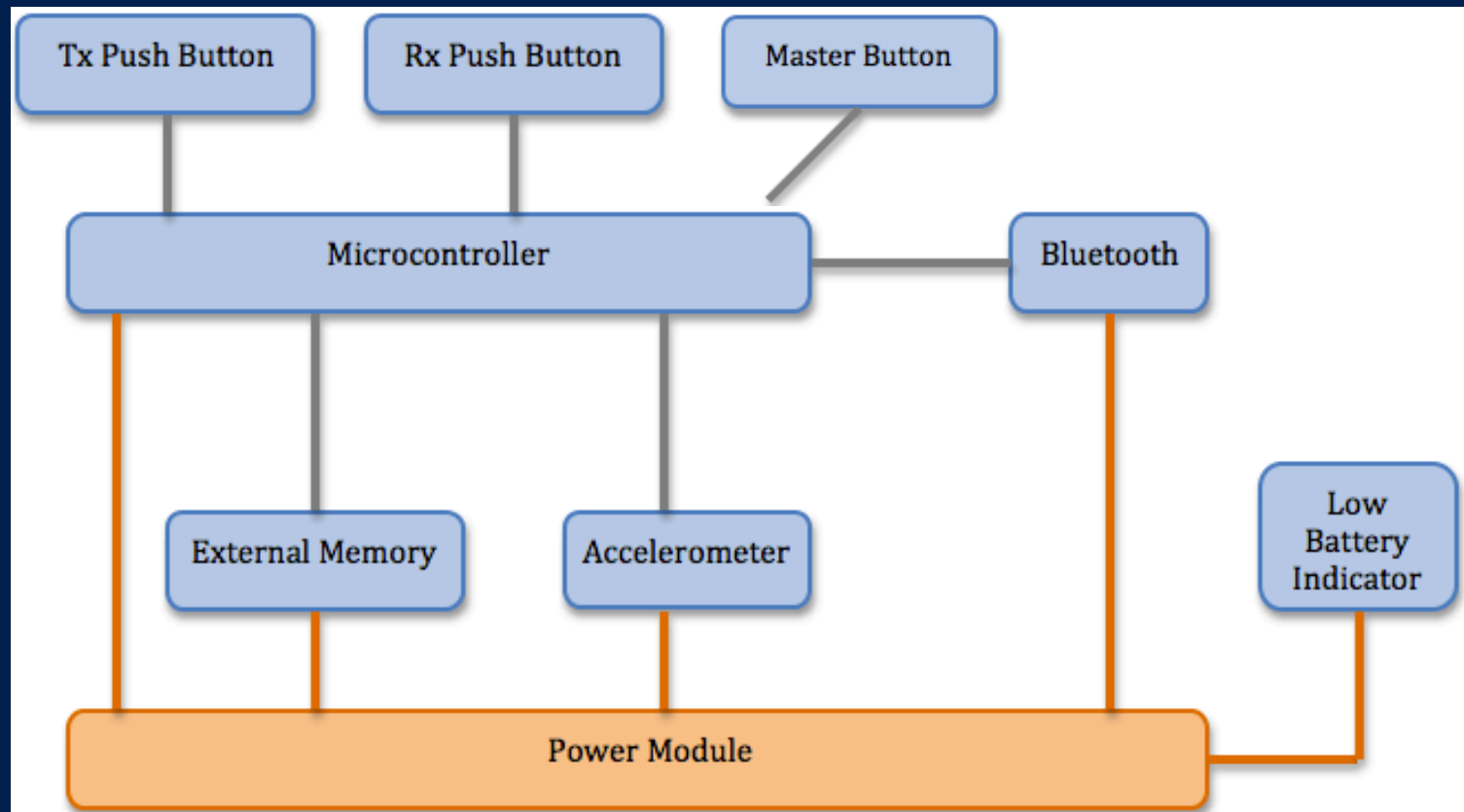


# INTRODUCTION & KEY FEATURES

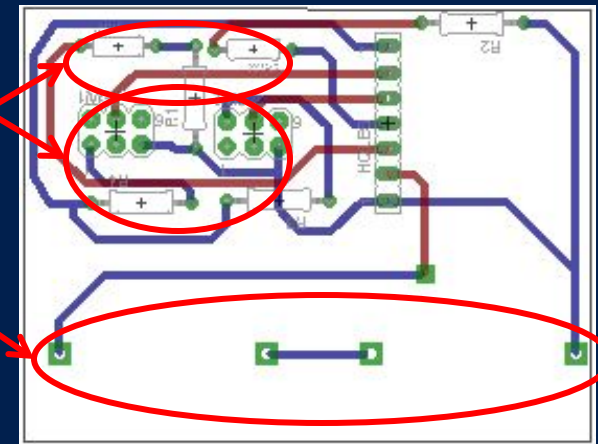
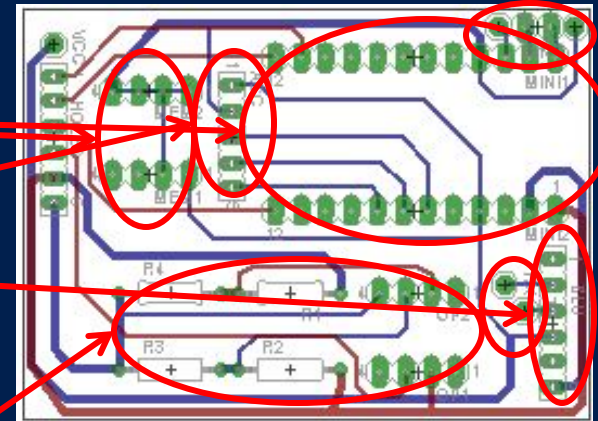
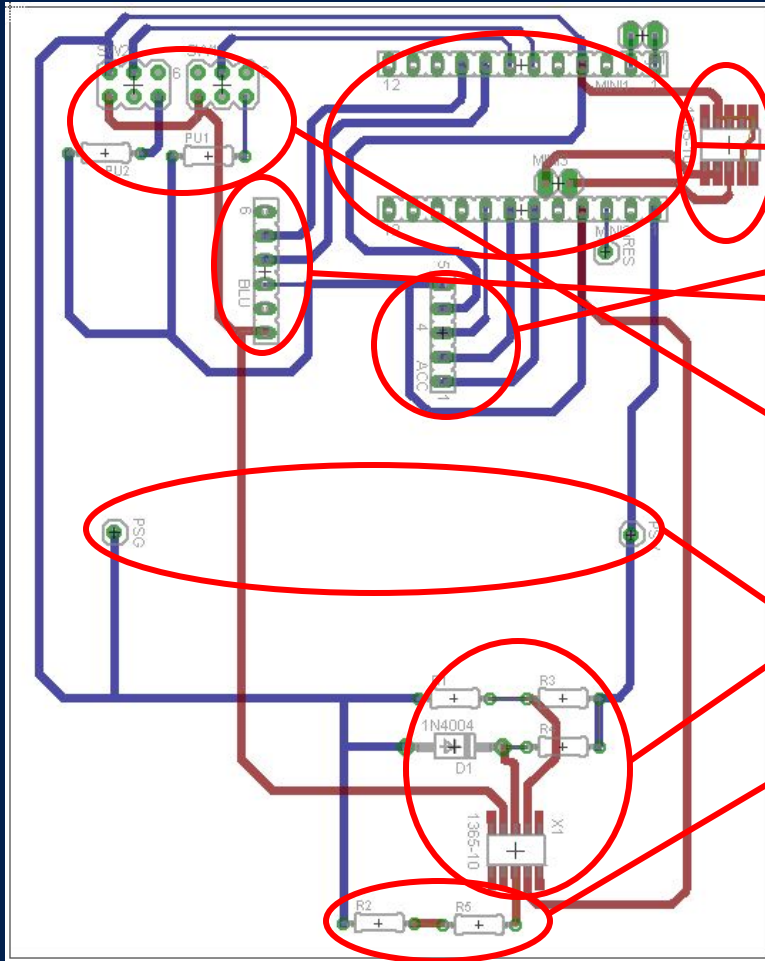
- Wireless exchange of contact information
- 4 modes — Off, Receive Only, Send Only, Receive & Send
- Stores up to 160 cards
- Low battery indicator
- Low memory indicator
- Received business cards can be uploaded to a personal computer
- Data can also be uploaded to a Smartphone
  - Useful if the other person does not own a bracelet



# DESIGN REVISION



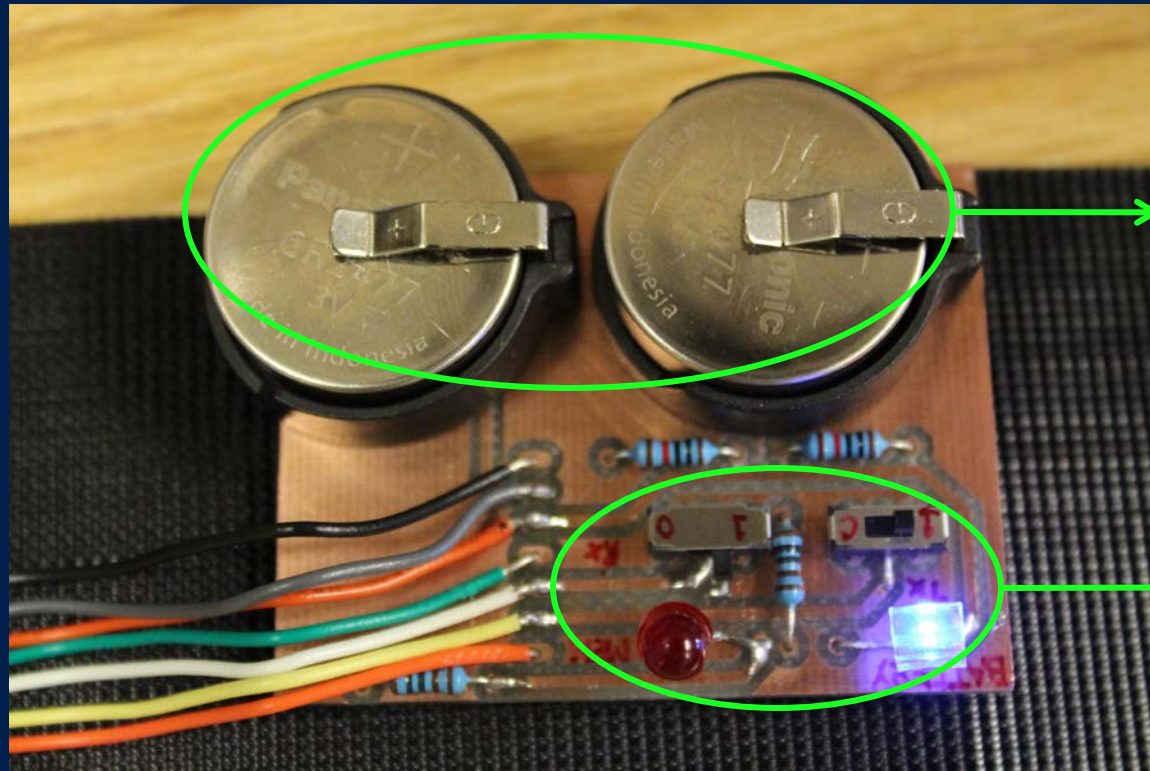
# PCB REVISIONS





# HARDWARE OVERVIEW

- Top PCB

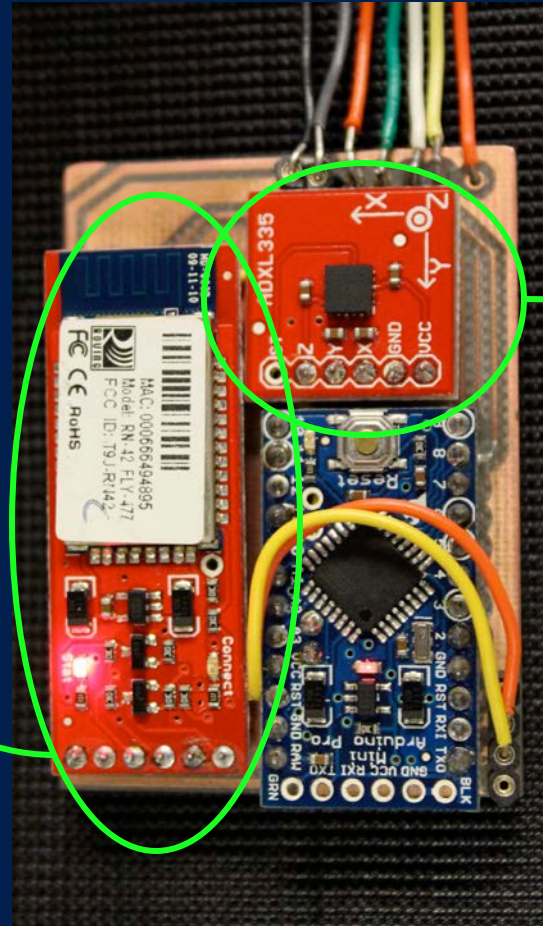


Power Supply

User  
Interface



- Bottom PCB



## HOW DOES IT WORK?

- Doesn't connect to any random device
  - All are undiscoverable when no handshake
  - Before handshake use Switch to set one as *Master*
  - Upon handshake, *Slave becomes discoverable & master connects*
  - After data transfer, *Master kills connection*
- At the end of the day, one can view all business cards by uploading *VIEW* code to device
- To update one's own business card, edit and then upload *UPDATE* code to device





# REQUIREMENTS & VERIFICATIONS

## 1. Accelerometer

- Detect acceleration due to gravity in x, y & z directions
- Detect acceleration due to motion



# Accelerometer Verifications

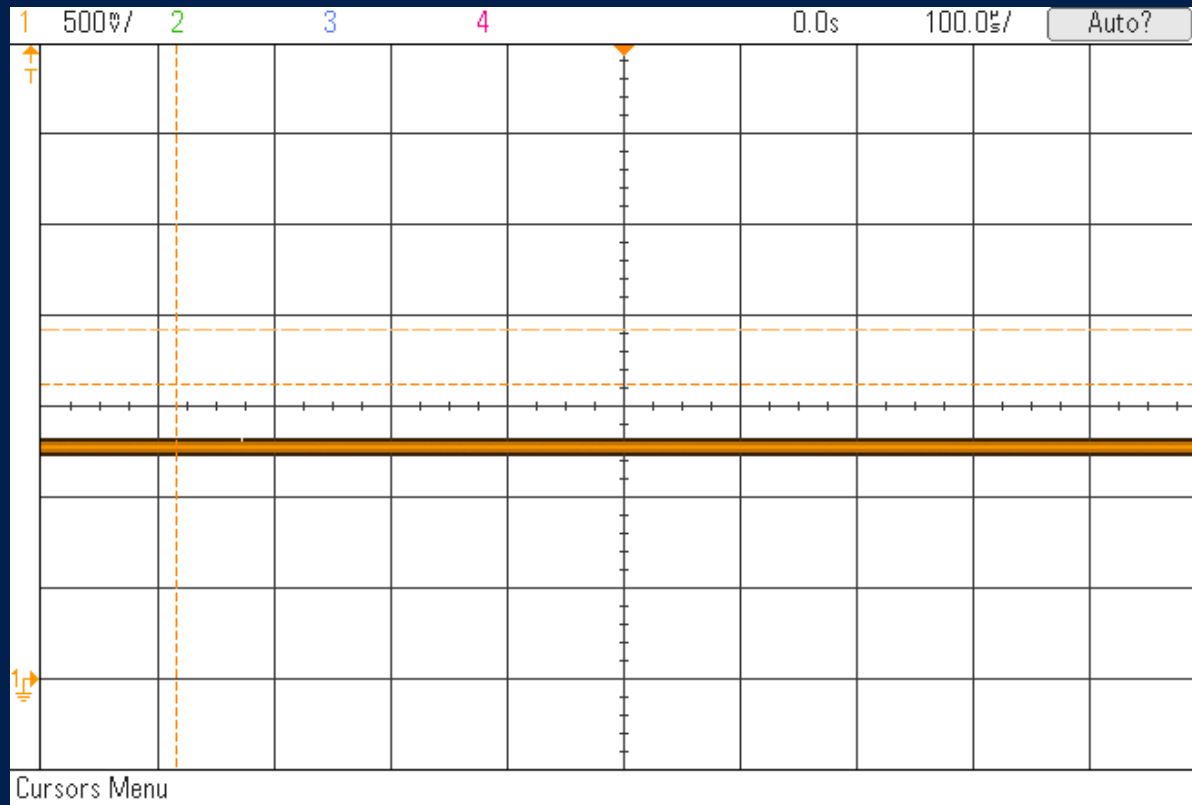


Figure: Oscilloscope Output for Accelerometer

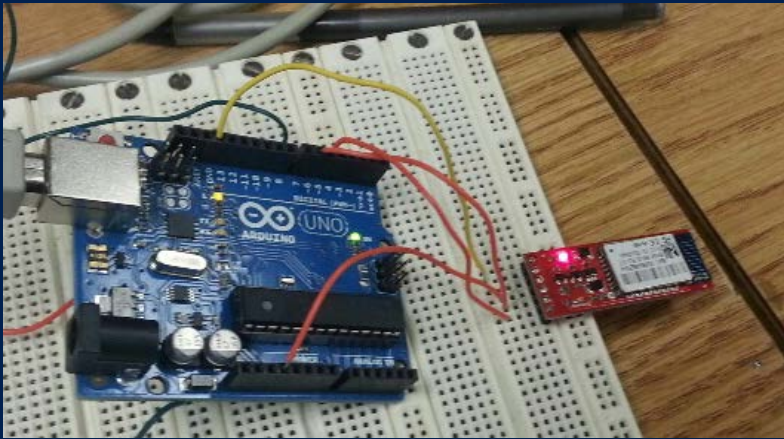


## 2. Bluetooth Module

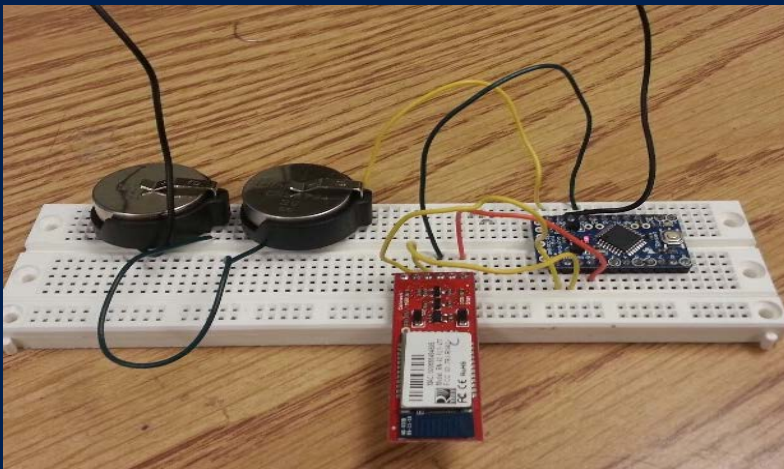
- Connect & communicate without error within 0.2m – 5m
- Data transfer less than 2 seconds
- Kill connection after transfer completed



# Bluetooth Verification



- Simple code to send characters from computer between Bluetooth modules



- After relayed between modules, characters were printed back to the screen to ensure errorless data transfer

### 3. External Memory

- When writing to memory
  - *data should be stored in correct address specified by code*
- When reading from an address
  - *correct data should be printed to serial monitor*





## External Memory Verification

- 4 “mock” business cards written to separate memory locations
- Simultaneously read these 4 “mock” cards
- Print data to screen to ensure proper reading and writing functionality

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Batman  
Gotham City Inc.  
999-888-7777  
brucew@wayne.com



## 4. Switches

- Output logic high when on
- Output logic low when off

### Switch Verification

- Probe GND and switch inputs (3.3VDC) with oscilloscope.
- When toggled, switch outputs GND or 3.3VDC



# Switch Outputs

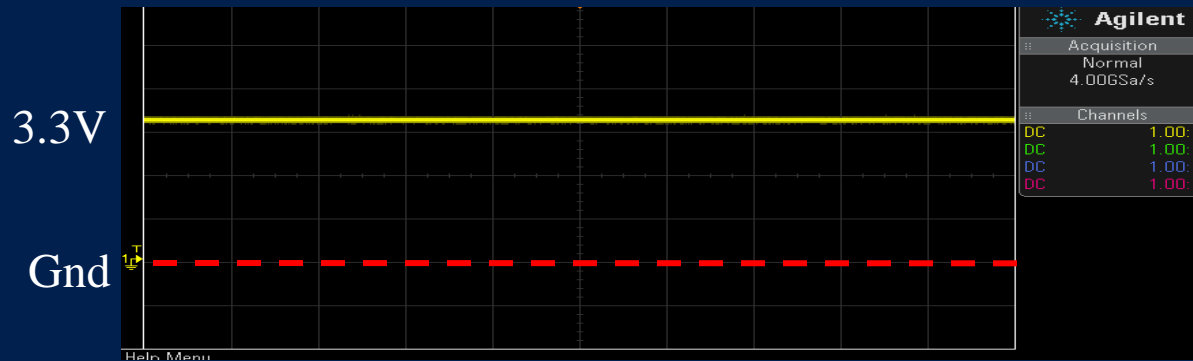


Figure: When switch is ON

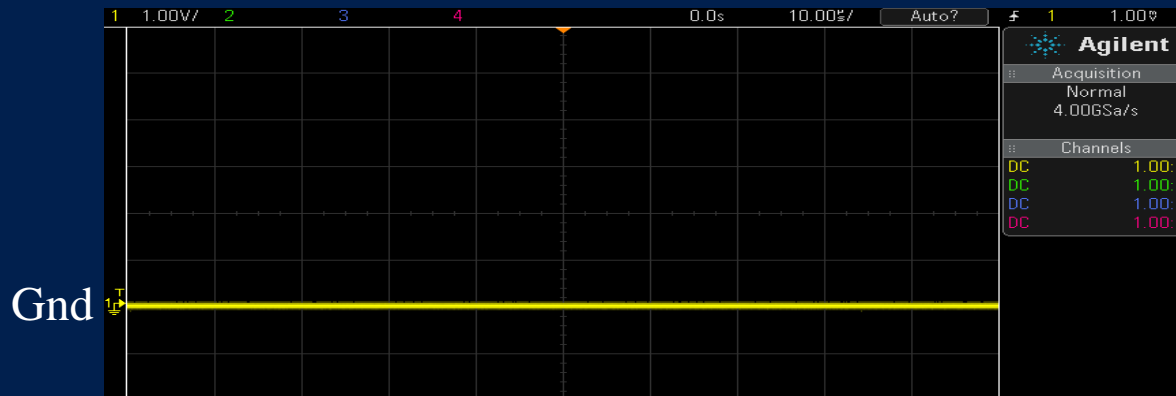


Figure: When switch is OFF



## 5. Low Battery Indicator

- Turn on LED when ~15% battery life is remaining
- $V_T \sim 4.8V$

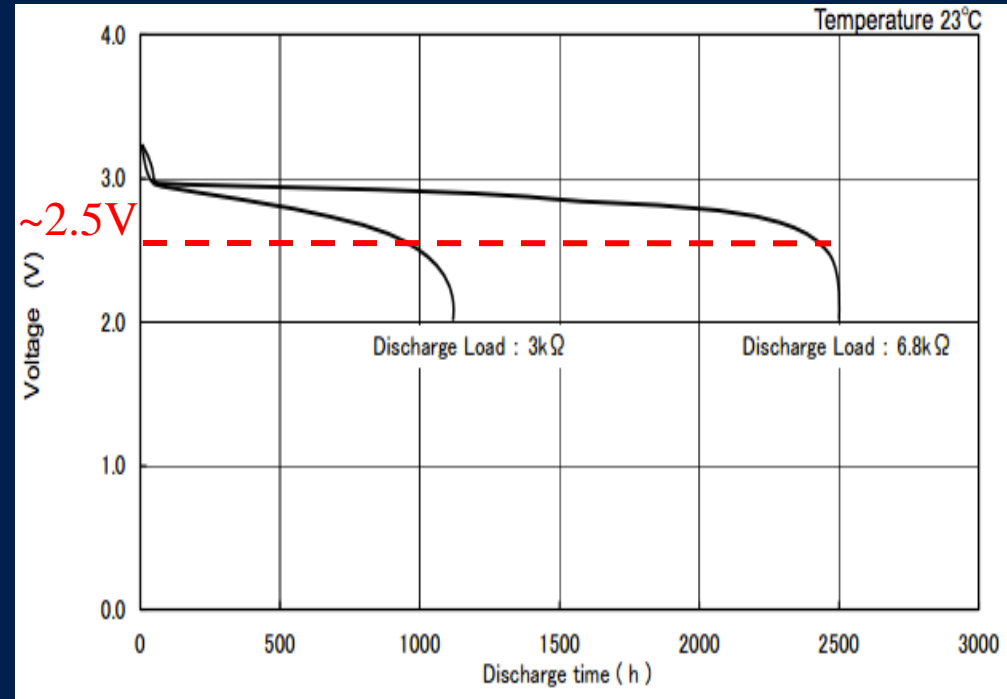
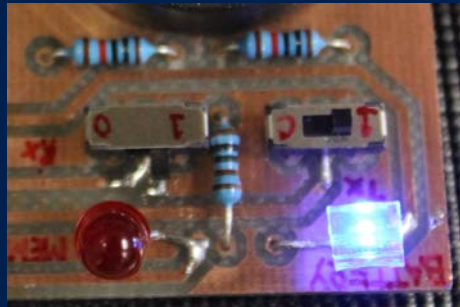


Figure: Battery Lifetime (from datasheet)



## Low Battery Indicator Verification

- Connect +6V DC power supply to circuit input and sweep
  - Verify that LED is off when  $V > 4.8V$
  - Verify that LED is on when  $V < 4.8V$



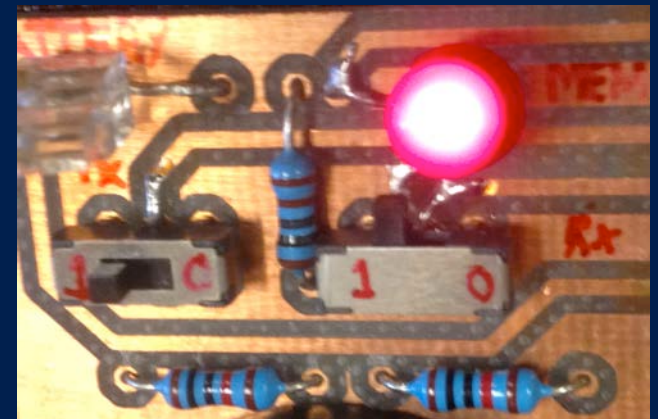


## 6. Low Memory Indicator

- Required to light an LED when  $\sim 15\%$  of memory remaining

### Verification

- Set low threshold (ex. 3 contacts) for testing
- Write “mock” data to memory
- Observe that LED lights up above threshold



## 7. Power Supply\*

- Outputs +6V to the Arduino RAW input pin
- Arduino  $V_{CC}$  outputs regulated +3.3V

### Verification

- Probe power supply output with the oscilloscope
- Output should be 6V +/- .5V



# PROJECT BUILD

1. Handshake Detection
2. Bluetooth Communication
3. Low Battery Indicator
4. Storing Data to External Memory
5. Microcontroller & Low Memory Indicator



# Handshake Detection

	<u>X</u>	<u>Y</u>	<u>Z</u>
	611	529	489
	611	528	489
	611	529	489
	608	539	488
	612	557	483
	619	564	489
	613	587	483
	590	608	490
	556	571	496
	520	556	495
	514	599	494
	553	672	476
	510	574	495
	486	511	496
	519	613	505
	519	598	501
	529	609	499
	523	613	501
	526	617	500
	523	610	501
	525	609	502
	525	612	500

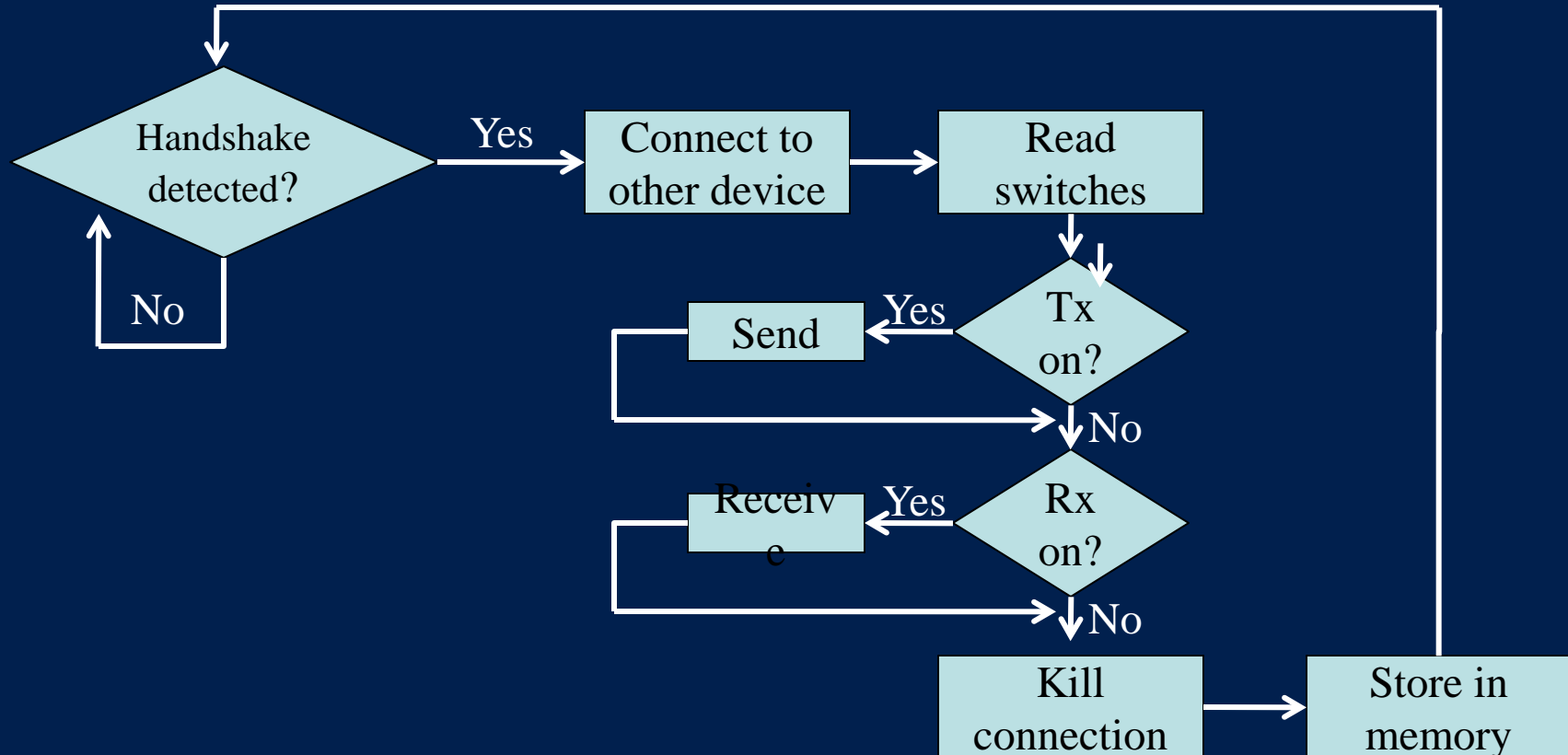
Arm swing



Handshake



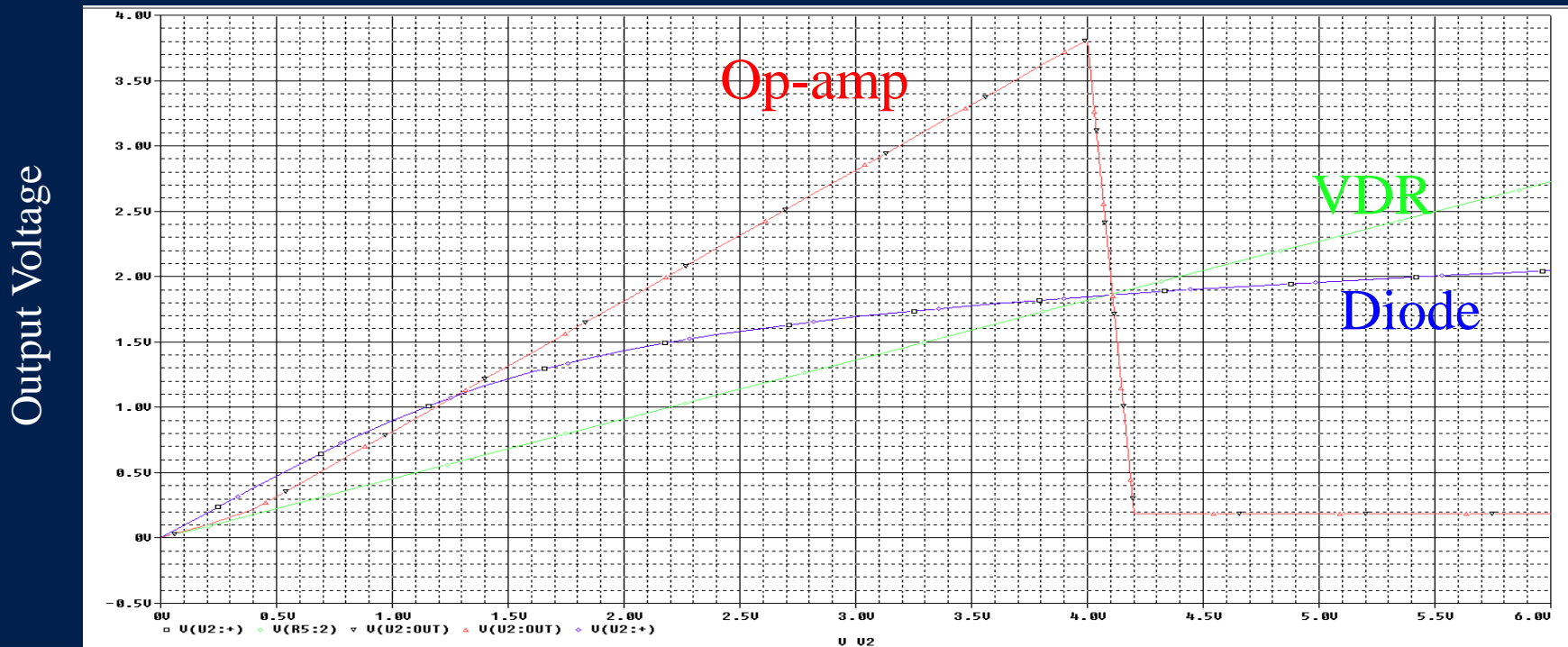
# Bluetooth Communication Protocol





# Low Battery Indicator

- Uses op-amp circuit as analog comparator
- Threshold to light up LED is set using
  - Resistor network
  - Zener diode



## Storing Data to External Memory

- Received business card is stored in a 200 byte structure after connection is killed
- Number of business cards stored is located in address 0
- Use this number and the number of bytes in a business card to write to the correct memory locations



## Microcontroller

- Used to control everything in the circuit
  - Processes data from the accelerometer
  - Tells Bluetooth modules to connect/disconnect
  - Sends/receives data from Bluetooth module
  - Writes and reads data from external memory
  - Indicates when the memory is low



## PROJECT SUCCESSES

- Successful data transfer between two devices upon a handshake
- Reasonable battery life (~62.5 hours)
- Stores up to 160 contacts
- Reasonable size and weight
- Successful data transfer to Smartphone if desired



# PROJECT CHALLENGES

- Bluetooth Module
  - Automatic connection & communication upon handshake
- Does not detect by false handshake
- PCB
  - Reduce size to fit on user's wrist





# FAILED VERIFICATIONS

- Power Supply failed when connected to entire load
  - Total load of circuit too big for button cells
- Solutions-
  - Step down voltage with *buck converter* or *transformer* to increase current supply to load



# FUTURE WORK

## 1. Eliminate Master/Slave Switch

- Use random delay on each device before attempting to connect
- Use *GK command* after connection attempt to check (returns '1' if connected, '0' if not connected)
- If connected, continue with data transfer
- If not connected, use another random delay and retry connection



2. User interface
  - App for Smartphone
  - Programmer for computers
3. Include contact picture in business card
4. Check for multiple copies of same person in external memory
5. *Sleep mode to decrease power consumption (BT module, etc.)*



# ACKNOWLEDGEMENTS

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- Justine Fourier, Ryan May, Igor Fedorov (check these)
- Professor Carney



# QUESTIONS & COMMENTS

