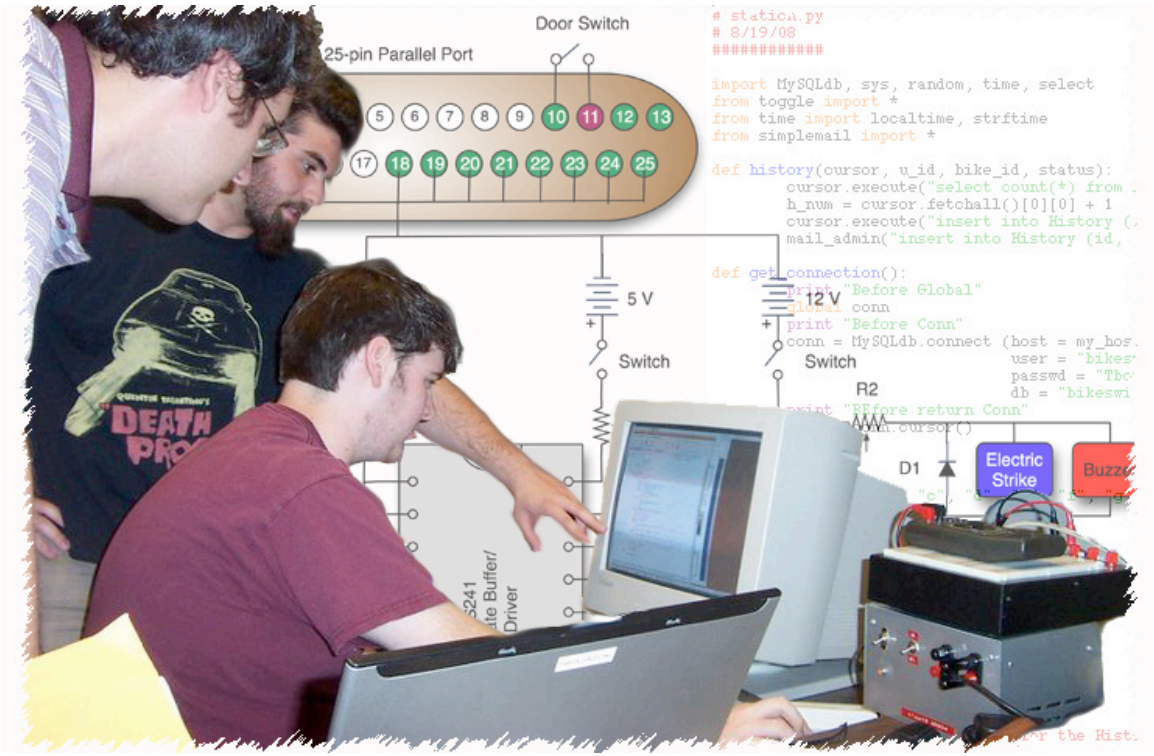
Design and Construction of an Automated Community Bicycle Loan/ Return System



Richard Lopez & Roland Womack

Student Research Forum

April 24, 2009

Introduction to Project

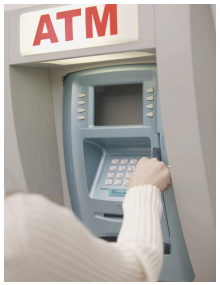
- **Regions Bikes**
- **Motivation**
  - **Current system is inconvenient**
  - **Similar systems already in use**

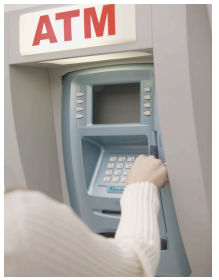
Research Goal

- **Can we design and construct an automated community bike share system in-house in a cost efficient manner?**
  - **Accessible and easy to use**
  - **Maintain security**
  - **Cost effective**
  - **Allow monitoring of information**

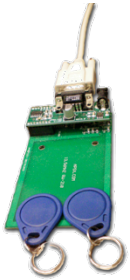
Approach

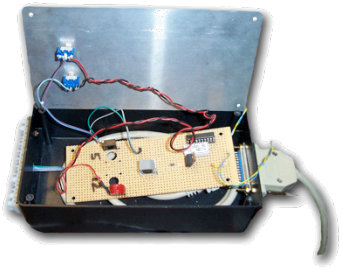
- **Assess the ideal system**





- **Determine the components**

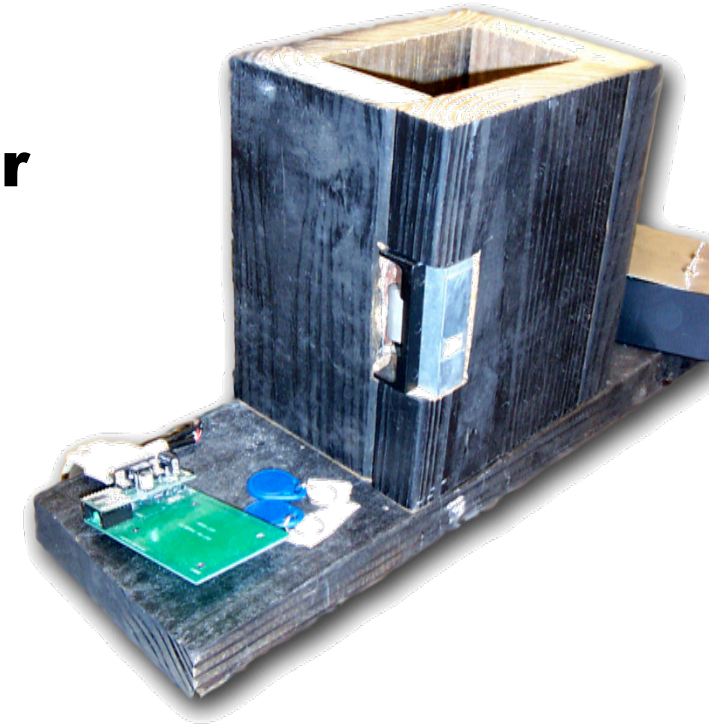




- **Combine the components**

Hardware Overview

- **Hardware:**
  - **Magnetic Card Reader**
  - **Box**
  - **Electric Strike**
  - **Switch Button**
  - **Circuit**
  - **RFID Antenna/Tags**

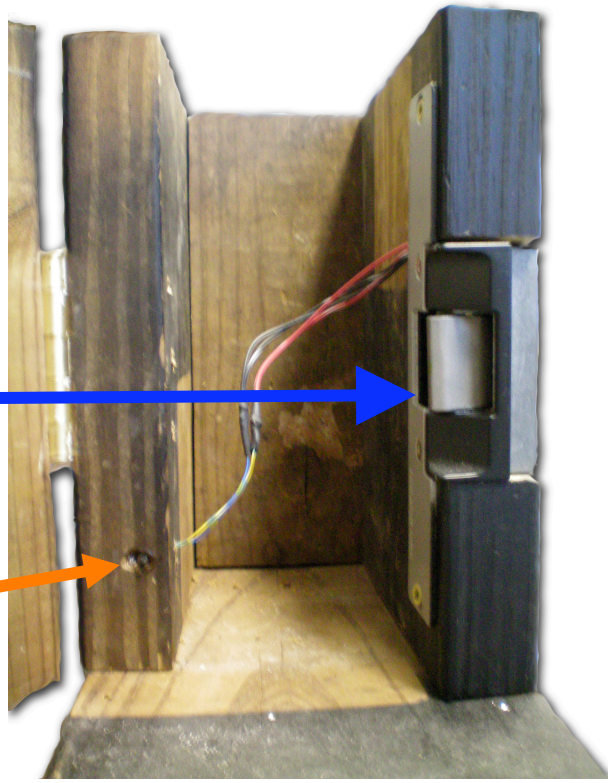


The Magnetic Card Reader

- **Lo/Hi Coercivity**
  - **Lo Co used**
- **Three tracks**
  - **Track 1 used**
- **Widespread Use**

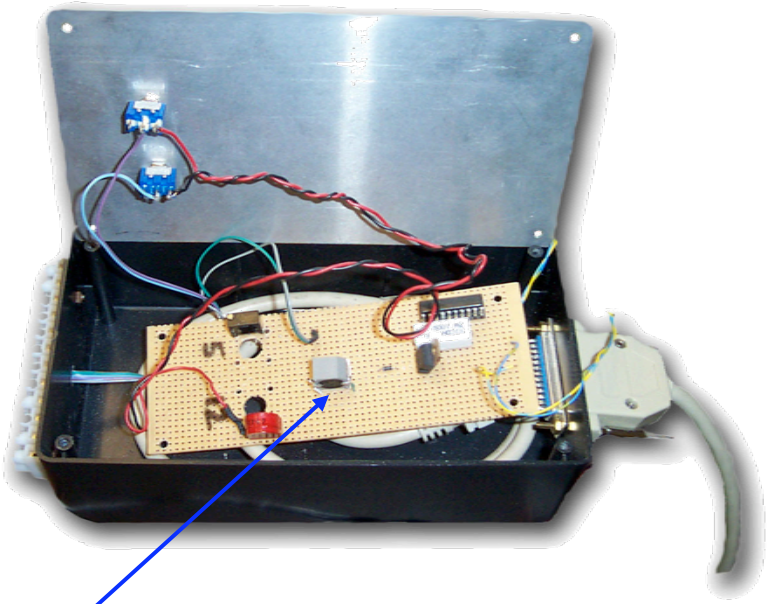
The Box

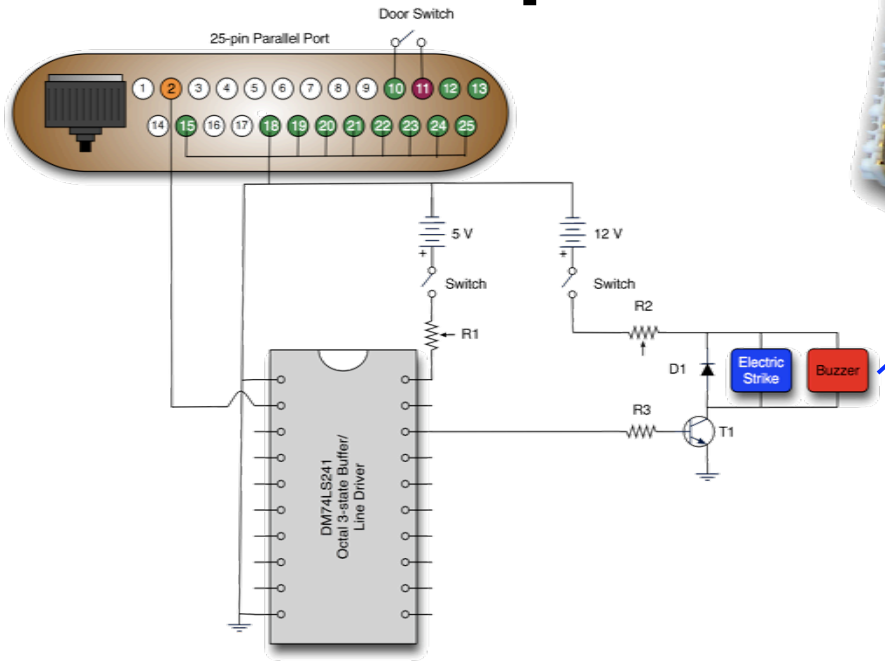
- **Box**
  - **Waterproof, Tamperproof**
- **Electric Strike**
  - **Door Lock**
- **Switch**
  - **Door Open/Closed?**



The Circuit

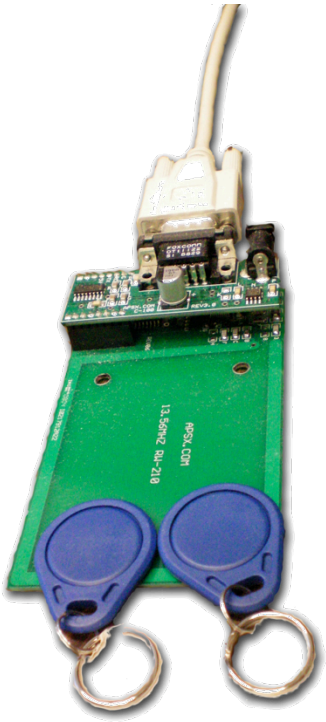
- **Parallel Port**
  - **1 bit input**
  - **1 bit output**
  - **12 V and 5 V power**





The RFID Antenna/Tags

- **Tags**
  - **13.56 MHz**
  - **Unique IDs**
  - **Read/Write tags**
- **Anti-collision**
  - **Multiple tags possible**



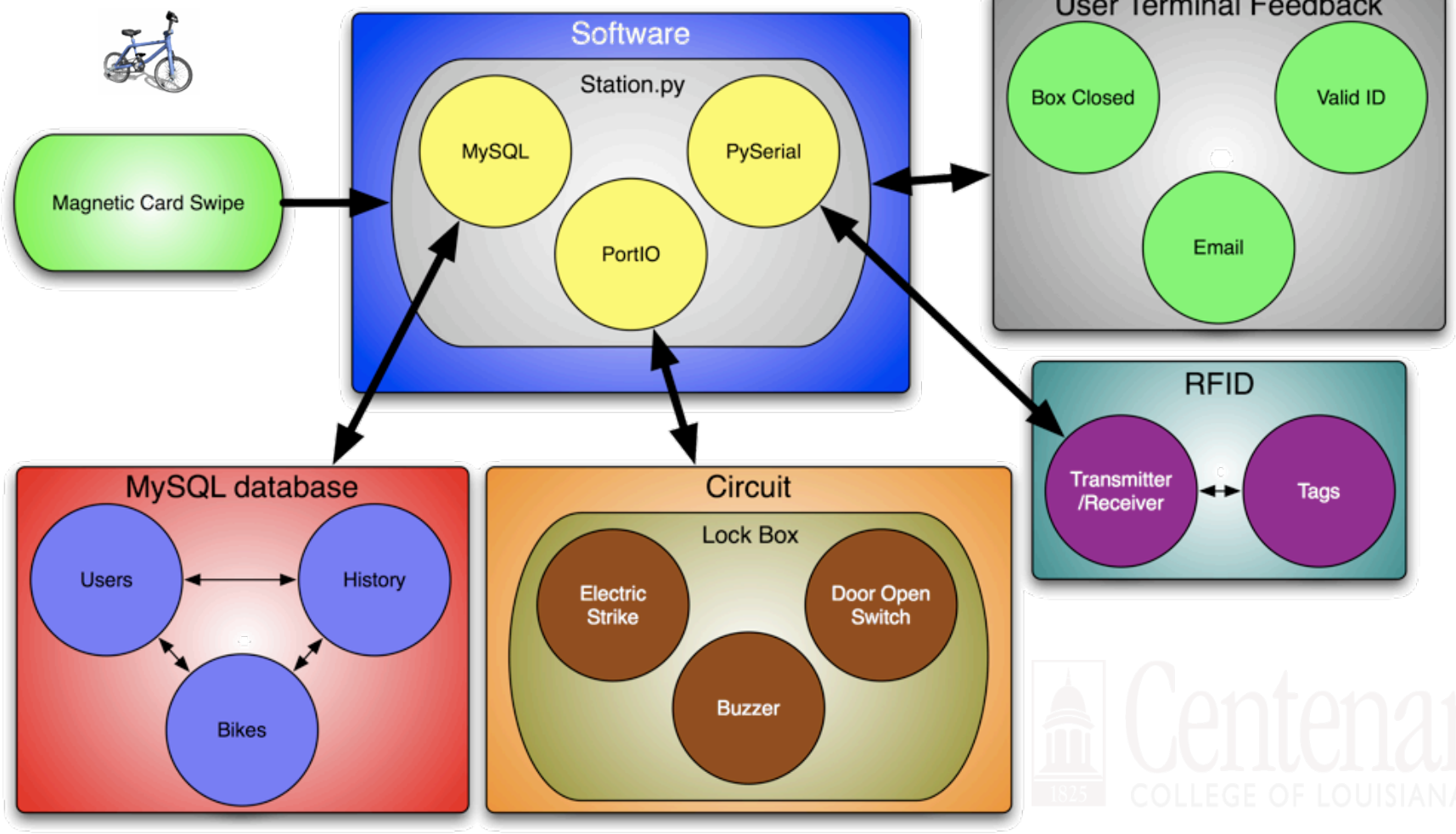
Software

- **Python in Linux**
  - **Open Source, Well Documented**
  - **Toggle.py/PortIO, RFID-serial.py/Pyserial, Simplemail.py**

- **MySQL Database:**
  - **Tables: Bikes, Users, History**

http://www.centenary.edu/physics/tmessina/bikeswipe

Bikeswipe Diagram



Budget

Equipment	Cost
Magnetic Card Writer	$115
Laptop	$320
Key Fobs (8 bikes)	$12
Magnetic Card Swipe (and converter)	$19
RFID Antenna	$83
Circuit Parts	$10
Electric Strike	$20
Box	$50
Solar Power Panels	$50
CPU	$200
Total Per Unit	$432

Conclusion and Future

- **Lessons Learned**
  - **RFID is difficult**
  - **Updates to the database**
- **Can we design and construct an automated community bike share system in-house in a cost efficient manner?**
  - **Yes, we can.**
- **What next?**
  - **Bike route maps**
  - **Card Swipes for doors**

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References

- “Centenary Goes ‘Green’ With New Bikes From Regions Bank.” Centenary College of Louisiana News Release: Office of Marketing & Communication. 10 Apr 2008.
- “New York Bike Share Project.” 31 Oct. 2008.
- Pollastri, Fabrizio. “PortIO, python low level port I/O for Linux x86.” PortIO v0.2 Documentation. 2006 – 2008. Fabrizio Pollastri. 13 Nov 2008.
- Series 4000 Reader ISO 15693 Library Reference Guide, Texas Instruments, 2nd Ed., 26 Jul 2004.
- “Simple Circuit Creates Magnetic Card Lock.” Electronic Design. 9 Nov 1999. Penton Media, Inc. 2008.
- "The world's most popular open source database." MySQL. 1995-2008. Sun Microsystems, Inc. 25 Jul 2008.