APM (Automated Programmer Machine)

The Programmers
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Problem

- Currently Atmel and PIC programmers can only be checked out from lab during TA office hours
  - TA’s must keep a record of who has a programmer checked out
  - History of theft and damage
  - Students can only program during TA office hours – impractical for a large project
  - Vast majority of students purchase a programmer due to the limited availability
Project Overview

Battery Backup
- 9V Battery
- 5V Linear Regulator

Power Management
- 120VAC
- 12V Switching Regulator
- 5V Linear Regulator
- Motors/Bezer
- VCC

Real Time Clock

User Interface
- LCD
- Push Buttons

TA Interface
- FTDI
- USB
- Terminal Program

RFID Readers
- Magnetic Card Reader

EEPROM
- Solenoid-Controlled Drop-Flap

DC Motors
- Dispensers (2 augers)
Project Overview

- Students swipe UFID card, and use the user interface (LCD & push buttons) to select which programmer they would like to check-out.
- Programmers identified through embedded RFID tags.
- TA: USB terminal interface and special front-end control.
- Provides accessible, real-time status updates for all students, programmers and transactions.
“The most tightly routed serial design board.” — Josh Childs
Student Interface Software Flowchart

Student Interface

Homepage

APU
00:00/00:00
Enter to Continue

Enter?

Read UID and compare to database

Please Swipe Color 1

NO

Match?

YES

Menu 1

Check out Arm
Check out PIC
Return a programmer
Check Status
Return Home

Return Home

Arm
PIC

Decision?

Enable RFID out
Tom motor on and
dispense programmer

Enable RFID out
Tom motor on and
dispense programmer

Enable RFID in
Open drop slot

Display student
status until they
press Enter

UID Not
Registered
Date: 00:00:00
Status

Display
Confirmation
Enter to Continue
Challenges

- RFID reader interference
  - Used RX select signal to drive PNP and NPN switches
- Atmega324P’s limited memory (32K Flash, 2K SRAM)
  - Stored data (primarily strings) in program memory
- DC motor limit switches
- Atmega324P can be powered through input pins
  - Isolated FTDI signals w/ BJTs
Possible Improvements

- Track additional lab supplies – FTDI, Xbee breakout boards, etc...
- Wireless communication
- E-mail/web updates
- Touch screen student interface
- TA interface GUI
- Memory (SRAM) expansion
- Automatically re-stock programmers
Questions?