MICHIGAN STATE UNIVERSITY

09/20: Prototyping

The Capstone Experience

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Fall 2010

From Students…
…to Professionals

Prototypes

- Developed
  - Early
  - Rapidly
- Implement Subset of the Requirements
- Done for Variety of Reasons
- Are Not Finished Goods
- "Hacking" (Good Sense)

Why? Answer Questions

- Help Determine
- Specifications
  - Functional
  - Design
  - Technical
- Usability
- How Existing Code Works
- Programming Languages
- Development Environments
- Operating Environments
- Etc…

Why? Determine Schedule

Determine how long will it take to…

- …learn the new programming language.
- …learn the development environment.
- …learn the existing code.
- …convert the existing code.
- …convert the existing database.
- …get libraries working.
- …deploy the application.
- Etc….

Why? Reduce Risk

- Operability
  - How do we make a game clock?
  - Where do we store the data?
- Interoperability
  - How does the game clock work with other tablets?
  - How do the tablets all write to the same database?
- Scalability
  - Will the game clock propagate in real time?
  - Will the database engine keep up?
- Reliability
  - What happens if the clock tablet dies?
  - What happens if the database tablet dies?
- Etc…

Speed (to Write)

- Critical
- 2-3 Day Tasks
- Use Whatever Works
  - RAD Languages
  - SDK's
  - IDE's
  - Design Tools
  - Wizards
  - Sample Code
  - Etc…
- Stop When Questions Answered

Tradeoffs: Speed (to Write) vs…

- Testing
- Documentation
- Security
- Software Engineering Best Practices
- Usability
- Performance
- Coding Standards
- User Interface Standards
- Using Real Data
- Etc…

Hence, Normally Not Appropriate in Final Deliverable

Challenge/Danger

- "Hack" Solution
  - It works.
  - It's *a* way to do something.

vs

- "Correct" Solution
  - It works.
  - It's the "right" way to do something.
    (There may be more than one "right" way to do something.)

Often My Biggest Frustration

Prototypes: Case Studies

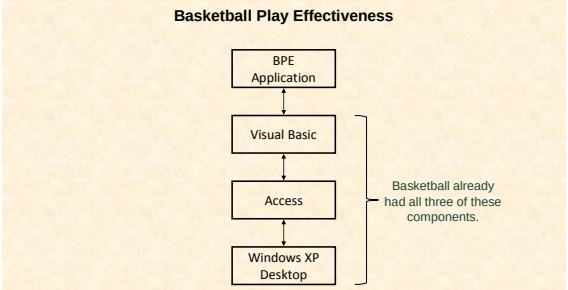
Basketball

- Play Effectiveness
- Player Timer
- Radio Stats
- Real Time Play Stats
- Plus/Minus

Basketball Play Effectiveness

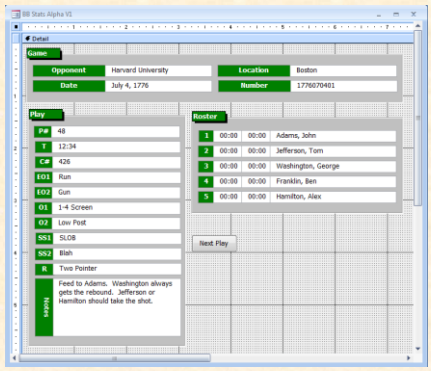
- Coaches Desired
  - Determine Effectiveness of Plays
  - Record All Plays with Result
  - Produce Report of Effectiveness
    - Each Play
    - # of Success / # of Attempts
- I Learned (During First Meeting)
  - Done After Game from DVR
  - Lots of Plays (~ 200) in Play Book
  - ~60-80 Plays Run Per Game
  - Plays Categorized
    - Early Offense 1,2 (E.g., Fast Breaks)
    - Offense 1,2 (E.g., Half Court Plays)
    - Special Situations 1,2 (E.g., Out of Bounds)
- Overwhelming

Basketball App Architecture



Risks

- Learning Basketball Processes?
- Programming in Visual Basic?
- Access?
- Building a GUI with Access/VB?
- Interfacing VB with Access?
- Generating Reports in Access?
- Etc…



BB Stats AV1

Fields
- P# Play Number
- T Time
- C# Clip Number
- EO Early Offense
- O Offense
- SS Special Situations
- R Result

Nota Bene
- Just Screen Layout
- No Code (Underneath)
- Never Have All Entries Filled at Once

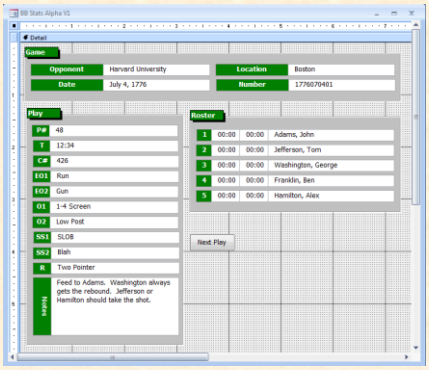
What I Learned From AV1 (1 of 2)

- Wanted to Identify Plays Within a Possession
- Plays Categorized Series / Set
  - Set is Variation on Series ("Parameterized Plays")
  - E.g.
    - Series: Thumbs
    - Sets: Up, Down, Circle
    - Plays: Thumbs Up, Thumbs Down, Thumbs Circle
  - 1, 2 Notation
    - EO1 = Early Offense Series
    - EO2 = Early Offense Set
  - ST (Special Teams) Missing

Huge Impact On Design

What I Learned From AV1 (2 of 2)

- Results Coded
  - X*N* Missed *N* Pointer (X1, X2, X3)
  - O*N* Made *N* Pointer (O1, O2, O3)
  - FF Foul on the Floor
  - TO Time Out
  - Etc…
- Wanted to Record Notes on Defense
- Didn't Care About Player Times



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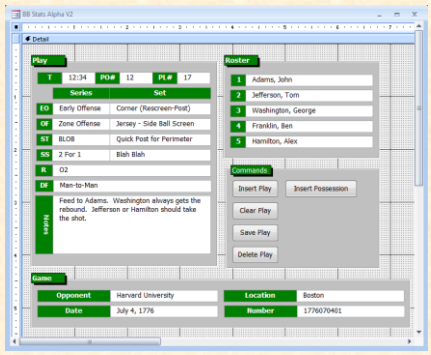


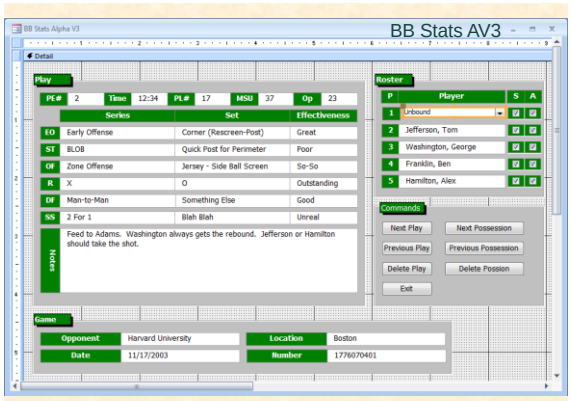
BB Stats AV2

Fields
- PO# Possession Number
- PL# Play Number
- SS Special Situations
- DF Defense

Nota Bene
- Just Screen Layout
- No Code (Underneath)
- Would **NOT** Have Entries in All Fields

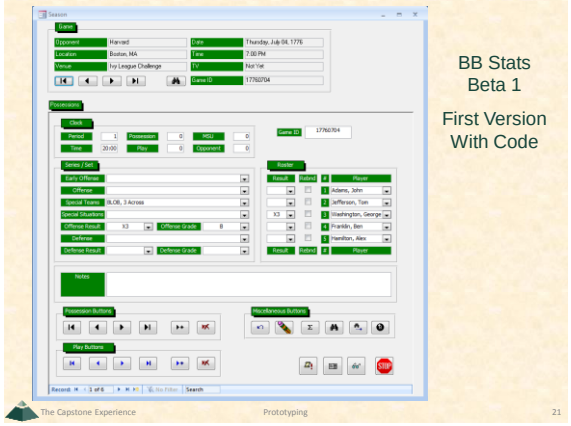
What I Learned From AV2

- Wanted to Grade Effectiveness of Plays
- Wanted to Record Player Steals and Assists (Remember this…)
- Needed to Navigate Plays and Possessions



What I Learned From AV3

- Wanted Grades to Be A, B, C, D, F
- Wanted Results to Be X1, O1, X2, O2,…
- Wanted Results Associated With Players
- Wanted Series/Set Combined
- Wanted to Record Player Rebound
- Did NOT Want to Record Player Steals and Assists

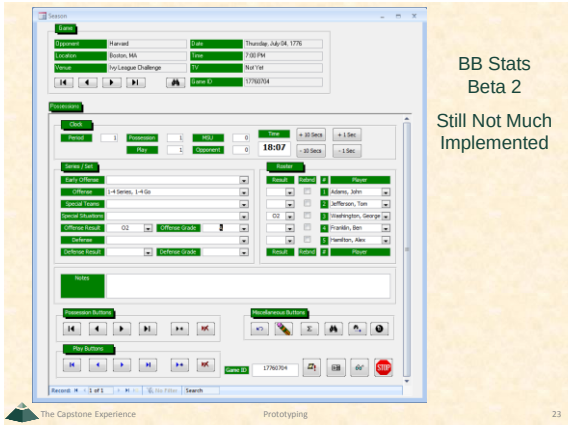


BB Stats
Beta 1

First Version
With Code

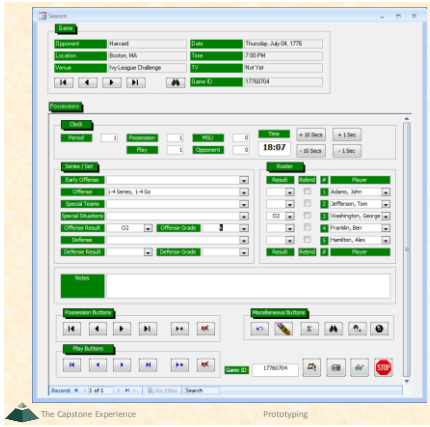
What I Learned From Beta 1

- Entering a Play
  - Some Things Calculated Automatically
    - Play/Possession Number
    - Score
  - Most Things Entered Via Pull-Down Menus
    - Series / Set
    - Result
  - But time Entered Manually (On Keyboard)
- Need Mouse-Only Input
- Need Easy Way to Adjust Clock



BB Stats
Beta 2

Still Not Much
Implemented

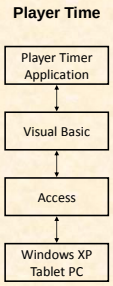


BB Stats
V1.0

Player Timer

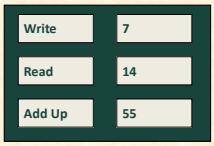
- For Each Player, Track
  - Minutes Played
    - Game Clock Time
    - Consecutive & Total
  - Minutes Rested
    - Wall Clock Time
    - Consecutive
- Must
  - Be Usable
    - On the Bench
    - In Real Time
  - Portable and Not Require Electrical Outlet
  - Feel Like a Pen and a Clipboard

Basketball App Architecture



Player Timer Prototypes

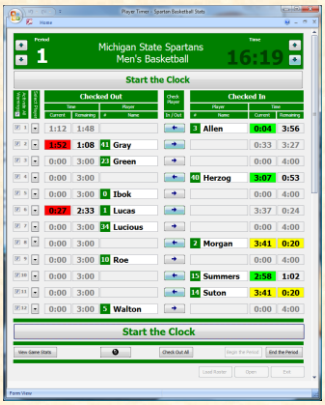
- Game Clock
  - Start / Stop
  - Counts Down
  - By Minutes/Seconds
- Access Interface
  - Write Number
  - Read Number
  - Add Up Numbers



Player Timer Development

- Knew Exactly What They Wanted, So…
- Designed "Final" Version
  - User Interface
  - Data Base Schema
  - Etc…
- Coded "Final" Version
- Lab Tested "Final" Version
- Field Tested "Final" Version
  - At a Scrimmage
  - Totally Unusable
- Scrapped "Final" Version UI

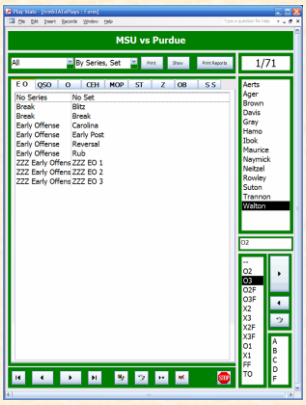
Huge Mistake!



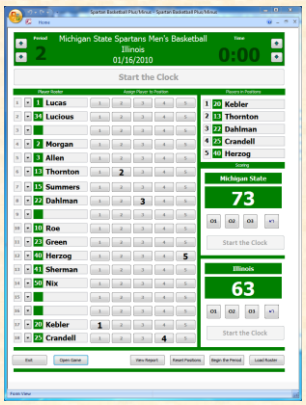
BB Play Timer

Software Updates

- Enable Clock Adjustments (While Clock Stopped)
- Enable Check In/Out By Touching
  - Check In/Out Button
  - Player Name
  - Player Slot
- Allow > 5 Players Checked In (While Clock Stopped)
- Enable Pending Check In (While Clock Running)
- Eliminate Almost All Modal Dialog Boxes



BB Offense



Plus/Minus

Your Prototypes

- What?
- Why?
- How?
- When?
- Where?

What's next?

- Team Status Report
  - PowerPoint Template
  - Due Noon, Monday, September 27
    - All Teams, Document and PowerPoint
    - Email to Dr. D.
    - Read Submission Instructions in Template
- Each Team Presents
  - Using a Team Laptop
  - At Most 15 Minutes (Rehearse Timing)
  - Single or Multiple Presenters (Your Choice)
- Dress is business casual.
- "Formal" Team Pictures Right After Meeting