

ENHANCING THE USABILITY OF THE HUMAN MACHINE INTERFACE

HANDHELD INTERAGENCY IDENTITY DETECTION EQUIPMENT (HIIDE)

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Agenda

- HIIDE 4
 - System Analysis
 - Purpose
 - Functions
 - HMI Factors
 - Task Analysis
 - Task Deficiencies & Proposed Redesigns
- HIIDE 5
 - System Analysis
 - Relevant Modifications
- Conclusions and Process

HIIDE 4 System Analysis

HIIDE 4 System Analysis - Purpose

- Handheld multimodal biometric device
 - Collection & matching of iris and fingerprint biometrics
 - Collection of face biometrics & document information and images
- Deployed by the Department of Defense in the war zone
 - Fix the identity of unknown individuals (assist in friend/foe decision)
 - Packaging requirements (size, weight, battery life, etc)



HIIDE 4 System Analysis - Functions

- Enrollment
 - Collects fingerprint, face, iris and document (biographic information)
 - Creates new record with unique id
 - Stored according to EBTS standard and including timestamp
- Match
 - Collect fingerprint and iris information
 - Match local watchlist, result conveyed in red/green alert
 - No record match result allows for enroll
 - Record kept of all matches
- Upload/Download
 - Uses laptop docking station
 - Synch with authoritative database



HIIDE 4 System Analysis - HMI Factors

- Device Form Factor
 - Tactical device
 - Light weight, small (fit in BDU)
 - Two hands required for operation
- Biographical Data Entry
 - 3x2 inch touch screen + stylus to enter tasks and data
 - Alternate approach is offline through laptop docking station
- Quality Control of Biometric Capture
 - Controlled by user
 - Awkward subject positioning
 - Untrained user, harsh environment
 - Ability to override quality requirements



HIIDE 4 Task Analysis

Data

- Type
 - First hand knowledge and observation of training and novice interaction
 - Data collected on novice, moderate and experienced users
- Collection
 - Observation
 - Training courses
 - Demonstrations
 - Unstructured interviews
 - Discussions with operators returning from field
 - Discussions with trainers
 - Personal experience
 - Biometric expertise
 - Training instructor



Human Functions

- HIIDE Function Decision
 - Provides the function direction to the device (enrollment, matching or upload/download)
 - Controls the transitions between each function
- Data Collection
 - Essential to the accuracy of biometric matching
 - Position the subject and the device to capture a high quality face, iris or fingerprint image

Human Functions (cont.)

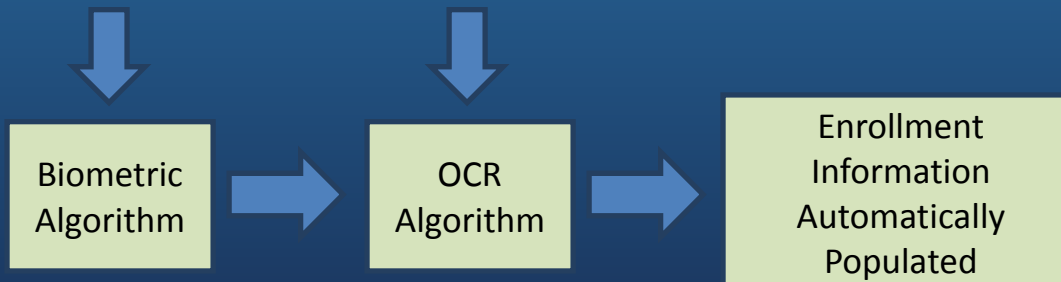
- Acceptable Quality Determination
 - Provides quality decision for face, fingerprint or iris image to be stored/matched
 - Override poor quality indicators
- Data Entry
 - Enter the biographic and contextual encounter information
 - Essential information for most utility from device
- Decision Processing
 - Process the match decision by considering the quality of the match and the contextual information

Deficiencies for Redesign Consideration

- Decrease of Sequential Tasking
- Capturing High Quality Biometric Data
- Reduce Collection Errors from Mislabeled Data
- Modify Device Form Factor

Decrease of Sequential Tasking

- Deficiency
 - Tasks completed in high stress environment
 - Many repetitive tasks
 - Difficult to complete on 3x3 touch screen with stylus & gloves
- Proposed redesign
 - Audio recording for contextual information to be entered at docking station
 - OCR of identity document data
 - Addressed via software and hardware modifications



Capturing High Quality Biometric Data

- **Deficiency**
 - Capturing high quality data requires a patient and well-trained operator
 - Poor quality data leads to 'Garbage in, Garbage out'
- **Proposed Redesign**
 - Remove quality control from hands of user
 - Allow device software to collect video stream of face, iris or document
 - Analyze each frame (or every n^{th} frame) and generate a quality score.
 - Top quality Image used for matching or stored for enrollment
 - The operator is notified when an image of sufficient quality is obtained,
 - Retry using video streams
 - Use default manual process
 - Addressed by a software modification.

Reduce Collection Errors from Mislabeled Data

- Deficiency
 - Collection errors often occur due to incorrect collection of fingers or irises (subject's or operator's right)
 - Significant implications in binning applications

- Proposed redesign
 - Fingerprint redesign through multi-finger collection
 - Iris redesign through multi-eye collection
 - Requires software and hardware modifications



Modify Device Form Factor

- Deficiency
 - Bulky and heavy design difficult to collect high quality images
 - Two handed design difficult in war zone environments
- Proposed Redesign
 - Leverage developments in cell phone industry
 - Small, cheap, compact, high quality lenses and sensors
 - Gyroscopes for position awareness and device reversal
 - One handed use
 - Re-balance device for one-handed operation



HIIDE 5 System Analysis

HIIDE 5 System Analysis - Purpose

- Modifications
 - Largely the same
 - One Noticeable Departure
 - Removal of Identification
 - Performed as a part of Enrollment function
 - Renewed Emphasis on 'cross-matching' biometrics



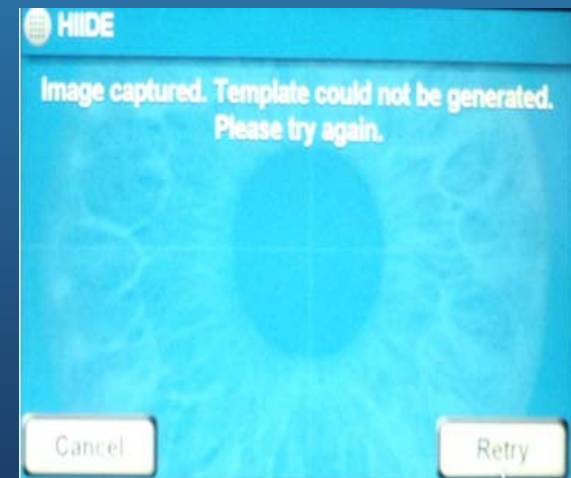
HIIDE 5 System Analysis - Functions

- Enrollment
 - Descriptive Images
 - Collection of multiple iris
 - Collection of multiple fingerprint
- Match
 - Biometric match removed as a standalone function
 - Biographic match only
 - Relies on proper spelling
 - Truthful responses
- Upload/Download
 - Unchanged



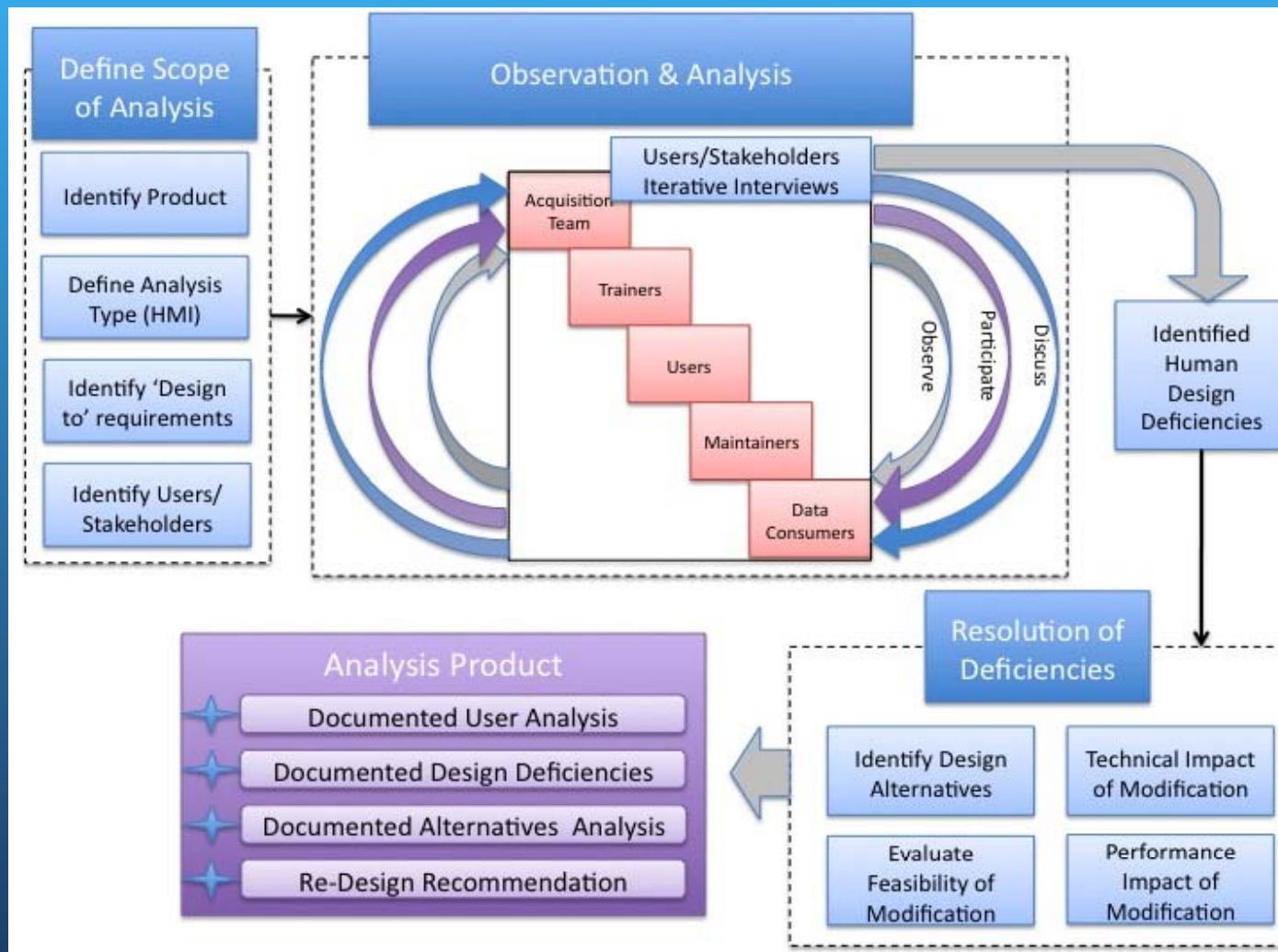
HIIDE 5 System Analysis - HMI Factors

- Device Form Factor
 - Threefold increase in size
 - Fourfold increase in weight
- Biographical Data Entry
 - Drop down menus
 - Ability to capture documentation
- Quality Control of Biometric Capture
 - Optical fingerprint scanner
 - Multiple collections
 - More prone to errors in harsh light
 - Dual iris camera
 - Independent Autofocus
 - Quality indicator removed



Process and Conclusions

Systems Engineering Process



Conclusions

- Biometrics serve as an enabling technology in the war zone
- Usability should be considered to improve device and biometric system performance
- Incorporation of suggested design considerations may
 - Improve data quality
 - Improve biometric system performance
 - Enable enhanced distribution of identity information to military and law enforcement
- Features of HIIDE 5 address some of these concerns.
- Must examine the tradeoffs between system elements



Questions?

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