A NEW AUTOMATED FIREARMS IDENTIFICATION SYSTEM USING 3D INFORMATION:

BALISTIKA

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Outline

- What is BALISTIKA?
- History
- System structure
- Data acquisition
- Comparison
- Visual inspection
- Salient features of BALISTIKA

What is BALISTIKA?

- **BALISTIKA is a ballistic image analysis and recognition system.**
- **It is:**
  - **High performance**
  - **User friendly**
  - **Scalable**
  - **Working on LAN**
  - **Depends on Client-Server architecture**
  - **Uses 3-Dimensional data!**
  - **Has a relational database that relates bullets, cartridge cases, incidences and individuals**
- **Product of TUBITAK BILTEN**

TUBITAK BILTEN

- Information Technologies and Electronics Research Institute of Scientific and Technological Research Council of Turkey
- Research areas:
  - Electronics
  - Information Technologies
  - Signal processing (image, video and voice)
  - IC design
  - Satellite technologies
- Has a staff of:
  - 150 research staff
  - 40 administrative staff

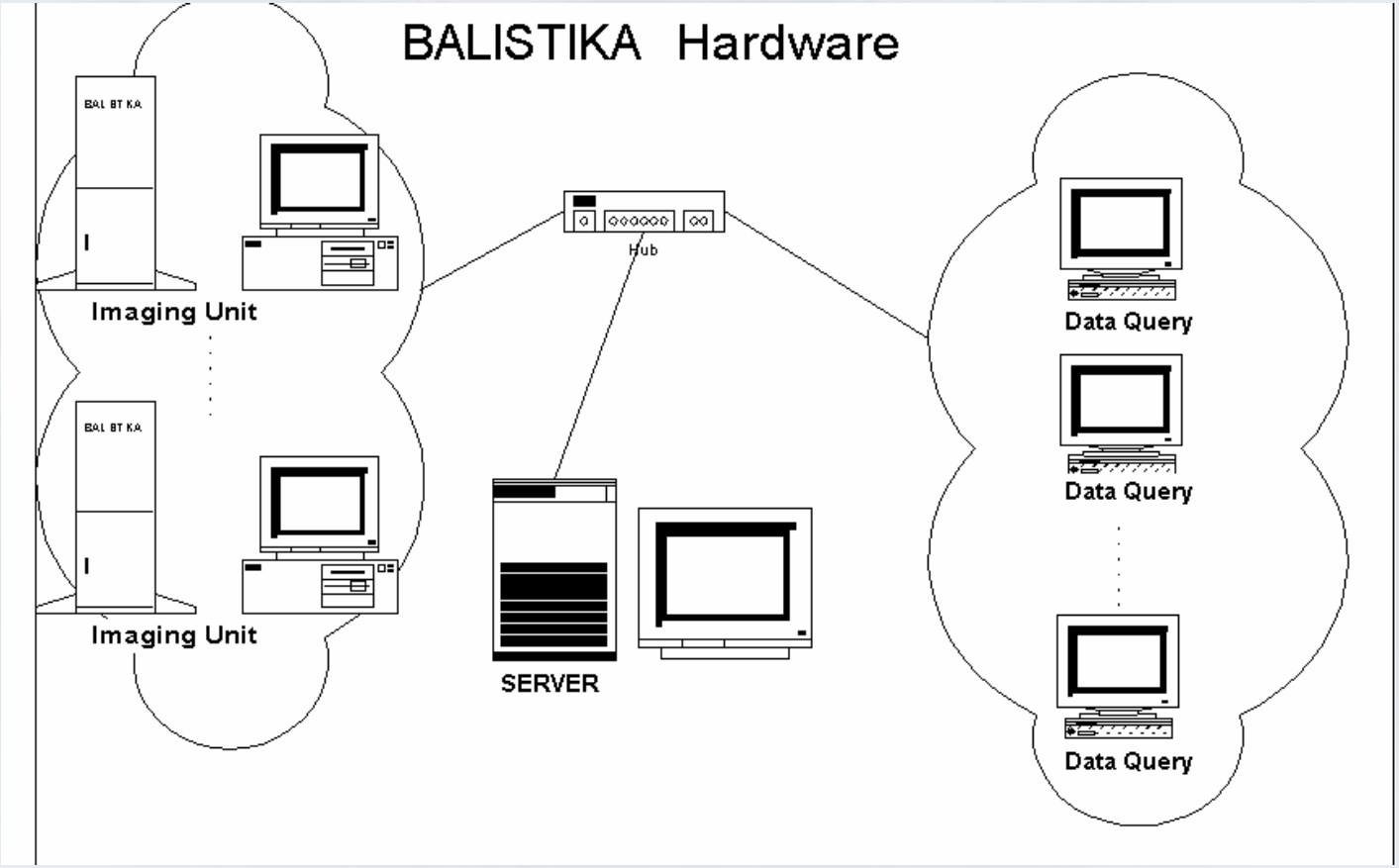
History

- Beginning of studies goes back to 1995
- Studies started with General Command of Gendarme, Criminal Laboratories Department (CLD)
- First a cartridge case and bullet archive system was developed
- Later, a project was started to design and implement ballistic image analysis and recognition system, with CLD
- BALISTIKA was born!
- With the help of CLD, BALISTIKA improved

History

- For the last 18 months, Police Criminal Laboratories of Security Department of Ministry of Interior Affairs (CPL)
- Extensive tests have been carried out, (the results will be give in another presentation)
- With the last touches, BALISTIKA became a state-of-the art product

System Structure



Workflow

- Data acquisition
- Comparison (matching)
- Query and visualization

Data Acquisition

- A cartridge recording takes about 2 minutes
- A bullet recording takes about 10 minutes
- All surface of the cartridge is imaged at once
- 3D information is extracted from 8 different images
- Have its own 3D extraction method

Data Comparison (Correlation)

- Comparison made in the Server
- Data comparison can be started manually or automatically
- Comparison set can be limited using queries
- Similarity of cartridge cases are made in the following categories:
  - Firing pin
  - Ejector mark
  - Breech face
  - Combined ranking
- Lists can be arranged according to ranks in those categories

Data Query and Visualization

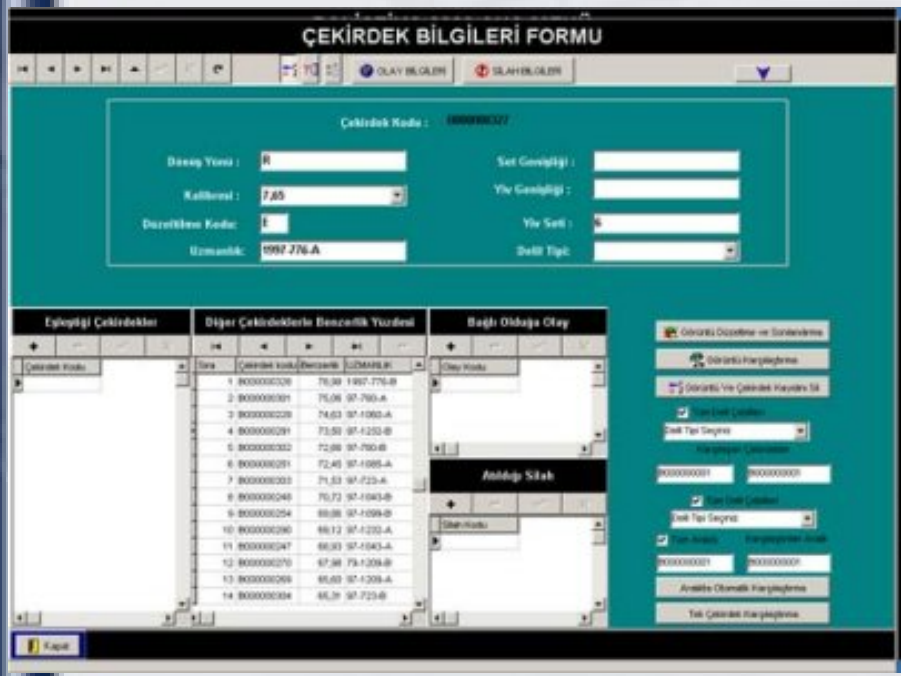
- There can be one or more Data Query Units distributed over a network
- Superior image quality
- 3D data provides the capability to use a virtual light over cartridge cases and bullets
- Two monitors allow user to see all data and images at the same time

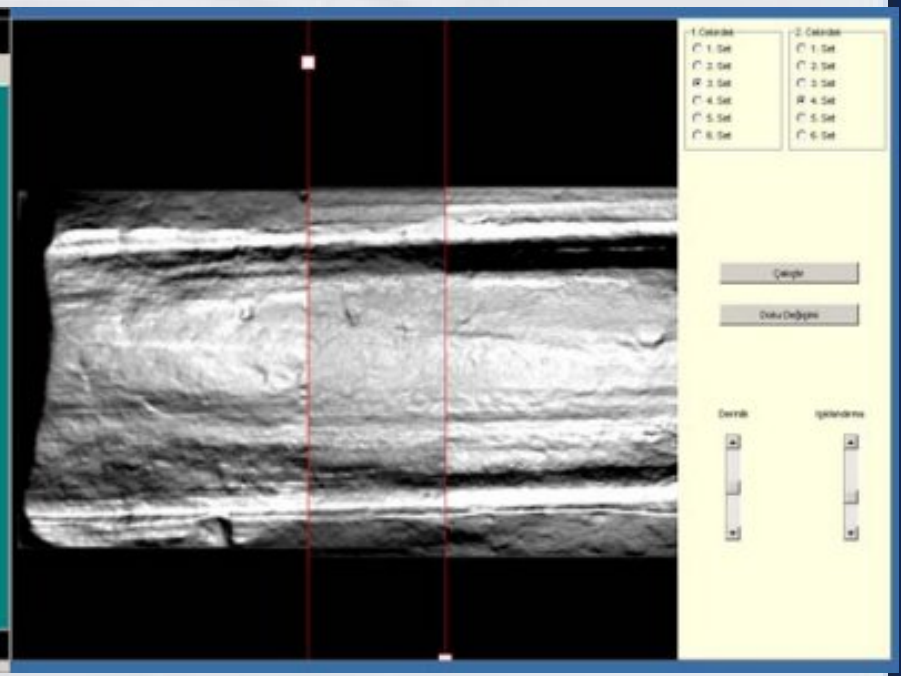
Data Query and Visualization

- A typical cartridge case comparison window

Data Query and Visualization

- A typical bullet comparison window





Why and How 3-D?

Why?

- The visibility of tool marks is highly dependent on illumination
- 2D images do not necessarily carry the full 3D information, which may be very helpful for matching

How?

- BILTEN have developed its own 3D shape extraction system
- 8 different light sources
- 8 different images
- Algorithms reconstruct 3D shape with that data

Network Support

- BALISTIKA inherently has network support
- Computers connected via LAN
- Has client-server architecture

Database

- Uses MS SQL Server as DBMS
- Has a relational database, linking:
  - Bullets/Cartridge cases
  - Firearms
  - Incidences
  - Individuals

Future Plans

- WAN (development and) test
- Continuous performance improvement
- Further exploration of features of 3D data

Thank You!

Questions and Comments ☺

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