MOBOTIX

... the cost efficient way for intelligent recording of HiRes video!

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The Company
Who is MOBOTIX?

Development & Production of High Resolution Cameras
(IP cameras, megapixel)

Development of Video Management-Software

(MxControlCenter) System Parts for Installation & Control
MOBOTIX Headquarters Kaiserslautern

Current Building

New Building

4,500 sqm office • 3,000 sqm production - 1,000 sqm div.
MOBOTIX: Facts and Figures

Private Stock company founded in 1999 by Dr. Ralf Hinkel, Sabine Hinkel and Klaus Borcher

Public 2007
- Headquarters in Kaiserslautern, Germany
- 2003 Subsidiary in USA (New York)
- 240 Employees, R&D and Production Made in Germany
- Offices in UK, France, Spain, Japan, Australia, New York
- more than 130,000 cameras installed since 2001 (Export >60%)
- business year 2008/2009: 35.3 Mio € Revenue, 50% Growth
- MOBOTIX is a Software Company with Hardware Products
Why HiRes Recording?
The CIF Story: lowest possible resolution

Most installations worldwide utilize CIF recording
- 352 x 288 lines (PAL), analog camera module
- 352 x 240 lines (NTSC), analog camera module
- 320 x 240 lines (1/4 VGA), mostly digital or by clipping

Lowest possible resolution

- 352 x 288 lines = 101,000 = 1 Megapixel

Typical mobile phone camera

- 1.3 ... 3 Megapixel (13x ... 30x more resolution)

Typical digital consumer camera

- 3 ... 7 Megapixel (30x ... 70x more resolution)
The CIF Story: 60 year-old problem

Analog cameras use a 60 year old TV standard
• 704 x 576 lines (PAL), analog camera module
• 704 x 480 lines (NTSC), analog camera module
• 640 x 480 lines (VGA), mostly digital or by clipping

Best resolution of analog camera
===> 704 x 576 lines = 405,504 0.4 Megapixel

The problem:

===> exposed in half frames with separate odd and even lines
CIF = half frame with LOST information between lines
===> 0.1 Megapixel (352 x 288 PAL, 320 x 240 NTSC)
Image Resolution: CIF vs. Mega

- **1.3 Megapixel**
  - CIF: 30 fps, 288 lines
  - VGA: 30 fps, 480 lines

- **0.3 Megapixel**
  - MOBOTIX: 10 fps, 960 lines

- **0.1 Megapixel**
  - Standard: 288 lines, CIF/2CIF
All MOBOTIX Cameras Use a 3 Mpix Sensor

- 3 Megapixel
  - 4 fps
  - 1536 lines

- 1.3 Megapixel
  - 10 fps
  - 960 lines

- 0.3 Megapixel
  - 30 fps
  - 480 lines

- 0.1 Megapixel
  - 30 fps
  - 288 lines
Arguments of the analog community
• too much network load
• expensive cameras and lenses
• require too much storage
• PC is overloaded at high frame rates

Benefits for users
• much better image quality and details
• less cameras (super wide angle covers entire room)
• less system and maintenance costs

==> would you buy a consumer still camera with 0.1 megapixel (CIF)
Megapixel Examples

M22-Secure with 2048 x 1536 image resolution
Megapixel Application

4 to 6 lanes of a gas station with one MOBOTIX camera
(Resolution 2048 pixels x 480 lines, clipping, 1F/s, 8 Gb SD-card, )

Other examples:
• 4 turnable gates at the soccer world championship stadium
• covering a entire room with one super wide angle lens (90°)
• virtual PTZ using fish-eye-lens (180°)
One MOBOTIX Camera Covers a Entire Room
Wider Area Face Recognition

1/40 \times 1280 = 32 \text{ pixel}

1280 \times 960 \text{ lines}

352 \times 288 \text{ lines}
Advantages of MOBOTIX Systems

(1) higher resolution (up to 1536 lines) and therefore less cameras
(2) higher frame rate at recording (40 cams x 30 frames/s)
(3) unlimited cable length using TCP/IP standard components
(4) video sensors with event recording already integrated
(5) video buffering inside camera bridges network failures
(6) no moving parts for higher reliability and no maintenance
(7) progressive-scan recording without half-frame blur during movement
(8) simultaneous live view, recording and research for multiple users
(9) remote access for live view, recording and event search
(10) unlimited users and cameras, expandable anytime
(11) no license fees, no software costs
(12) no maintenance cost
The MOBOTIX Solution
**Standard IP Cams** focus on video data transfer from point A to point B

- They simply simulate an analog video camera via a network
- They only offer an interface to fetch an image via network
- Need a central processing unit for event detection and recording
- The rest of the CCTV system functions is left to third parties

**MOBOTIX** offers a **complete system**

- Integrated concept: PC, management and recording inside camera
- Video management and administration included
CCTV camera
analog video cable
real time data/synchronous
DVR/PC

network camera
network cable
real time data/synchronous
DVR/PC

A/D
Logic

video management software

Logic

intelligent camera = PC
software & memory inside "camera"

network cable
NO real time network required
buffered asynchronous recording
10x better recording performance

(1200 VGA Frames/s)
Typical non-SmartCam System Structure

TCP/IP Network

PC / DVR

motion detection
and pre-alarm buffers
are inside PC

Storage

===> central **PC is a bottle-neck and high risk area** of the whole
Mobotix have no system limits and no central recording logic.
View 40 Cam Live on a Single PC

Network Power Supply
- NPR-20
- AT-8350GB

Gigabit Switch
- 48 x 100-Mbit
- 2 x 1-Gbit

Display
- 30 cams live each 25 F/s CIF

DVI

TFT-Display
- 1920 x 1200
- Samsung 243T

Standard PC
- P-IV 3.2 GHz

Record
- 30 cams live each 25 F/s (audio)

Extra Storage RAID Array

PC/Server
- Linux/Windows

Ethernet 100-Mbit
- approx. 100 m length

Live: max. 2 Mbit
Simultaneous recording, event search and live viewing
Live video for multiple users, recording and event search simultaneously possible in seconds from anywhere in the world via network

MOBOTIX multi user interface with different framerates and lip-synchronous audio
Development Philosophy

1999 idea: INTERNET Camera  ==>  99% in outdoor use

Design guide lines:
• no moving parts
• no additional outdoor housing
• no heating
• no AC power plug at camera
• no additional computer
• no additional modem
• no software installation  ==>  Web-browser

==> CMOS image sensor with powerful CPU but with no auto iris
What's inside?

Analog (FBAS) 0.1 - 0.4 Megapixel

Digital (TCP/IP) 1.3 - 3.1 Megapixel
Image in the normal CCTV world

4CIF Jitter at 576 lines

CCTV half-frame sensor

frame with odd lines
1, 3, 5 ... 575

frame with even lines
2, 4, 6 ... 576

MOBOTIX progressive scan sensor
The MOBOTIX Camera

How does it work?
By skipping the analog video signal and by integrating a powerful PC with a large software package for image processing and image analysis inside the "camera" ...

- no auto iris
- no analog camera module
- no analog signal
- no digitizer
- no compression chip
- no power supply
- no winter heating
- no weather housing
The Software inside the MOBOTIX Camera

- **Exposure Control**
  - reference windows
  - user program

- **Image Generation**
  - color generating
  - scaling (continuous)
  - distortion
  - noise reduction
  - sharpness

- **Video Codec**
  - MxPEG with audio
  - frame buffer, 10s

- **Recording**
  - frame scaling
  - buffering, 64 Mb

- **Playback**
  - simultaneously
  - search time/date

- **Image Analysis**
  - motion detection
  - noise detection

- **Alarm Management**
  - messages
  - trigger recording

- **VoIP (Video/Audio)**
  - SIP, H. 263
  - remote, touchtone

- **TCP/IP**
  - SIP
  - http
  - https
  - file
  - Win
  - Mac
  - Linux

- **Web-Browser**

- **IP**

- **NAS**
  - storage ringbuffer

- **SD-Card**
  - recording

- **LINUX PC inside Camera**
MOBOTIX Camera Portfolio (IP65, -30°...+60° C)

M12 Day/Night

D12 Indoor

D12 Outdoor

M22 Allround

D22 Allround

Q22 360 Degree
MOBOTIX Lenses

L22 Super Wide Angle 90°
approx. 90°H x 67°V
at 10 m appr.: 20.0 x 13.3 m

L32 Wide Angle
approx. 60°H x 45°V
at 10 m appr.: 11.5 x 8.2 m

L43 Wide Angle
approx. 45°H x 34°V
at 10 m appr.: 8.2 x 6.1 m

L65 Tele
approx. 31°H x 23°V
at 10 m appr.: 5.5 x 4.0 m

L135 Tele
approx. 15°H x 11°V
at 10 m appr.: 2.6 x 1.9 m
High Performance Recording

MOBOTIX 1,200 F/s VGA

Standard PC
Linux/Windows/Mac

Standard 200 F/s VGA
A “NORMAL” surveillance network
Why Mobotix?
Quality vs competitors
MOBOTIX Offers Parallel Video Streaming

Live streams (simultaneously)
- **multiple** video/audio streams (MxPEG, each with different frame rate)
- M-JPEG to standard browser
- preview M-JPEG (independent image size, lower frame rate)

Recording streams
- continuous, time-driven, event-based
- M-JPEG with pre- and post alarm sequences
- video/audio stream (if needed, different recording frame rate as live)

VoIP telephony stream
- standard SIP with H.263 video/audio (bidirectional) and remote control (I/O) via touch tones (telephone number pad)
The MxPEG Video Codec

• MPEG-4
  - was designed for **offline movie compression** (studio, large compute)
  - blurs moving objects in resolution and quality (still video browsing)
  - was **not** designed for short latency time of live cameras
  - low display capacity of HiRes videos on PC

• MxPEG
  - transports changing image regions with high priority/quality (security)
    - **no key frames** and **no difference coding**
  - network robust because
  - efficient decoding allows dozens of live streams on PC screen
  - multi-stream design with different frame rates (synchronized audio)
    - live stream and recording stream can differ in frame rate !!!
  ==> multi-channel access and short latency were design goals
  ==> supported by Barco, Milestone, Seetec, Winston, Verint
Scaling is done by software and not by hardware

- therefore **no scaling artifacts**, no skipping, no binding inside chip
- every resolution and aspect ratio possible
- clipping reduces storage size (i.e. 1000 x 250)

Various standard output formats

- 2048 x 1536, 1280 x 960, 1024 x 800,
- 800 x 600, 640 x 480, 320 x 240, 160 x 120
- D1-Pal (720 x 576), D1-CIF (355 x 288)
2.0 x Zoom
3.2 x Zoom
Video Sensor Inside Camera

activity bar with trigger

compensation zones
Exposure Measurement Zones

backlight safe using CMOS sensor and measurement zones
(robust without auto iris)

variable exposure zones
Depending on the placement of the light or light sources, in reference to the camera, directions are created. The main alternate directions offer special effects, one not being more correct than the other. However, without insight of the alternatives, light can be tricky to handle.

- **Frontal light** (the sun in your back) – creates a well-illuminated object
- **Sidelight** – may create great architectural effects but will create shadows
- **Backlight** (straight into the lens) – difficult to handle, since silhouettes are created and detail lost

Exposure Zones Inside Camera

Night

Day

==> improved backlight handling without autoiris
CMOS sensor
Dual Lens Technology Inside Camera

original 2 x 90° = 180°
corrected and fusioned
Lens Distortion Correction Inside Camera

Lens Correction and Continuous Zoom and Pan
- lens correction and zoom using MxCC (activeX)
- lens correction inside camera (stepless zoom and pan)
Soft-PTZ Inside Camera

Real PTZ Feeling with Joystick

- 180° in each direction
- continuous variable zoom
VoIP / Video-SIP Inside Camera

- simple interface for remote access and alarm messaging
- huge opportunity to connect video to mobile phones

==> automatic dial-up to every PC or IP-phone
Two-Way-Audio (VoIP) & Door Opener

- light relay 1000W (2-pol)
- door relay (1-pol)
- 2 switch inputs (12 - 230 V)
- audio amplifier (3 watts)

**Options:**
- battery backup (5 AAA)
- 230/110 V power supply
Applications: World Championship Stadium

Soccer Stadium Reference

- 77 MOBOTIX cameras
- integration of analog PTZ cameras (live, recording, PTZ)
- less expensive solution of all stadiums, installed by SIEMENS
Applications: World Championship Stadium
Applications
Web-Cam with Logo Generator

M10-Web: Megapixel Camera with Logo Generator
multiple logos • free outline with holes • transparency • time driven

Free Contur

1280 x 960 Pixel
Web: Weather Monitoring at Zugspitze
Security: Bank
Security: ATM Cash Machines

Dual image: Portrait triggered by money access
Number Plate Recognition at Fendt

Night

Day
Monitoring of Gas Stations
Water Management: Remote Monitoring
Florida Pump Station Monitoring

almost 200 MOBOTIX cameras in decentralized network
Singapore Polytechnic Campus

==> almost 1180 MOBOTIX cameras for monitoring
1000 MX Cameras for Singapore

Main features asked for:
- megapixel recording (1280 x960 lines) with audio
- frame rate scaling to reduce storage load (MxPEG)
- direct camera recording to reduce number of PC/DVRs
- automatic camera update and configuration functions

Details:
- approx. 1000 cameras for new location of Polytechnic
- reference project for two years at old location (85 cams)
- no third party software, direct camera recording
- tender has been won in June 2007
Image scaling, image analysis, frame scaling, recording of HiRes video streams require

- a huge increase in computer performance
  or
- an expensive multiple PC structure
  or
- a new system architecture by outsourcing more functions (video motion detection, stream buffering, recording logic) from the central management PC into the camera
MOBOTIX is using a decentralized system architecture with intelligent cameras since 2001

- onboard image & frame rate scaling reduces network storage load
- onboard video motion detector and event handling
- onboard recording logic for external ringbuffer administration
- onboard recording buffer bridges network failures
- onboard alarm messaging (mail, telephone)

==> performance consuming functions of the central video management software have been outsourced into the camera itself
MOBOTIX: a Cost Efficient Way of Surveillance

• **Image Quality:**
  - high resolution minimizes number of cameras
  - dual camera replaces set of cameras

• **Intelligent Recording:**
  - minimizes number of recorders for fluent video by a factor of 10
  - bridges network failures

• **Low Power Consumption:**
  - PoE during summer and winter, no heating necessary
  - very low backup power requirements
Advantages of MOBOTIX Systems

- no license fees, no software costs
- MOBOTIX has a unique IP-Video Concept
- high resolution up to 1536 lines (3.1 megapixel) and variable image format
- high performance in live view, recording and search
- unlimited cable length, using TCP/IP based standard components
- robust against backlight, network failure and environmental conditions
- efficient in power consumption and network load
- no moving mechanical parts offer higher reliability and no maintenance
- universal integration through additional functions (VM, Audio, SIP, I/O, RS-232, USB, SD-Card)
- standardized via browser: Live, Audio, Search, Administration
- unlimited number users and cameras, expandable any time
- no license fee, no software costs

Cost effective with less amount of cameras and recording devices
Thank you