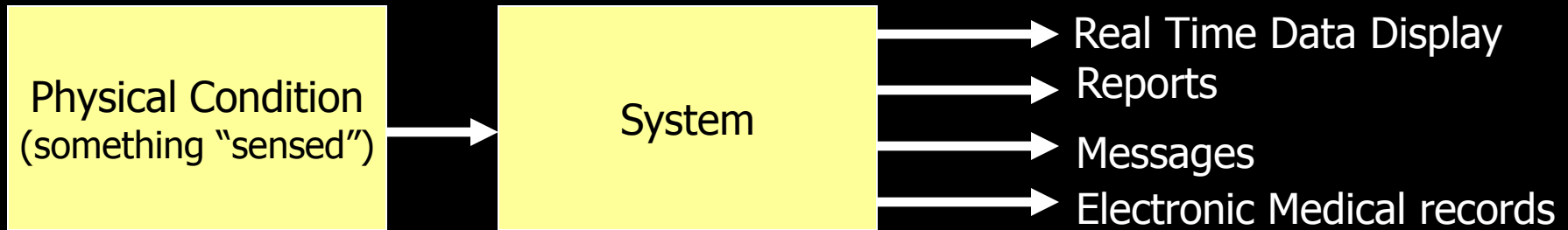


# Sensor Assisted Care



*PMDI Conference  
November 18, 2010*

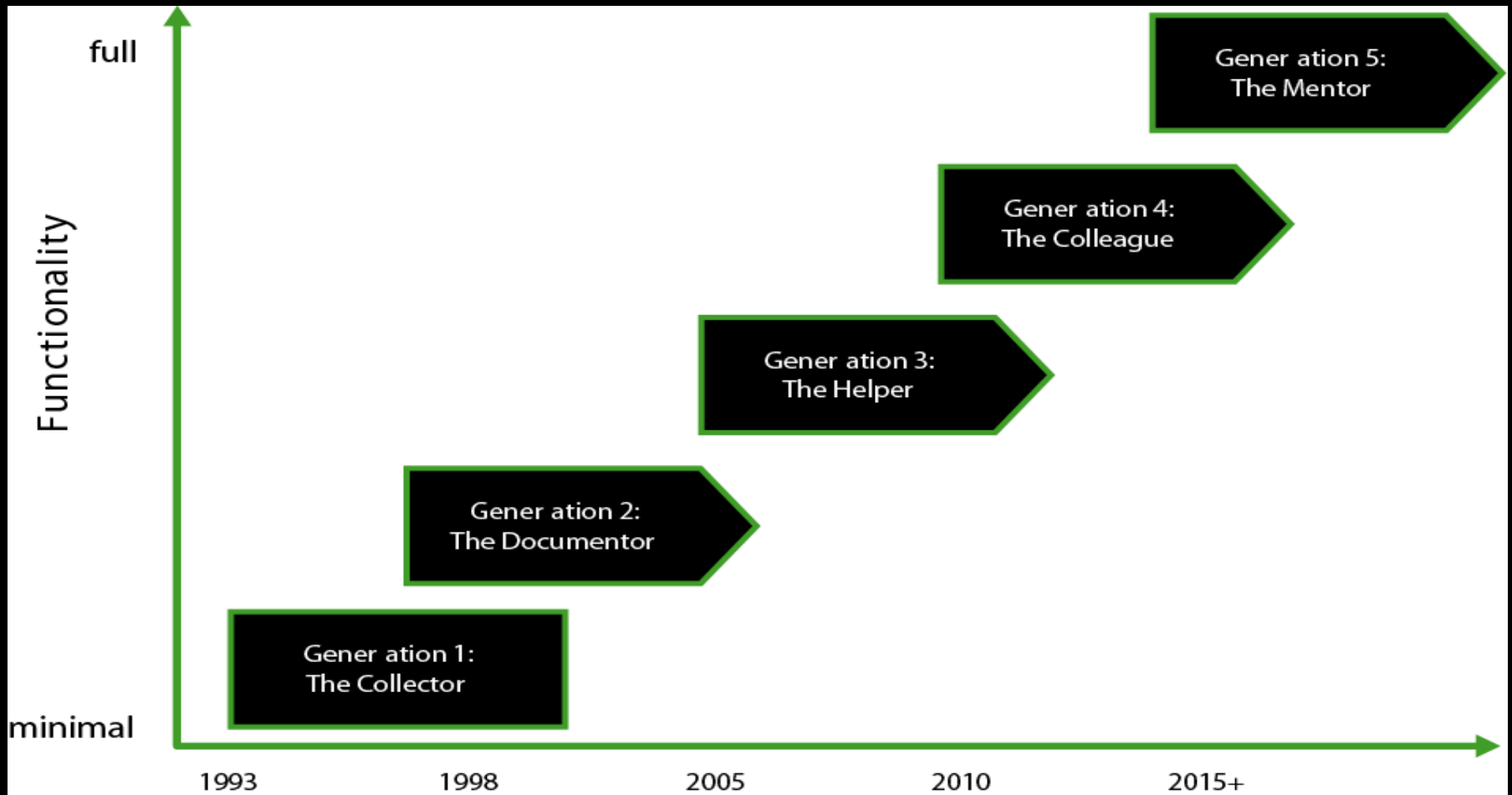
# Healthcare Overview

- ▶ Largest Segment of US Economy
  - \$2.5 Trillion in 2009 (17.3% of GDP)
  - \$7,143 per person
- ▶ Pending Crisis
  - Retiring Baby Boomers
  - 35 million Americans over age 65 ... growing!
- ▶ Shortage of staff
  - *One million new nurses will be needed by 2016*
  - more than 587,000 new nursing positions created by 2016
- ▶ Automation is a tool
  - improve care
  - lower cost

# Healthcare Industry Problems

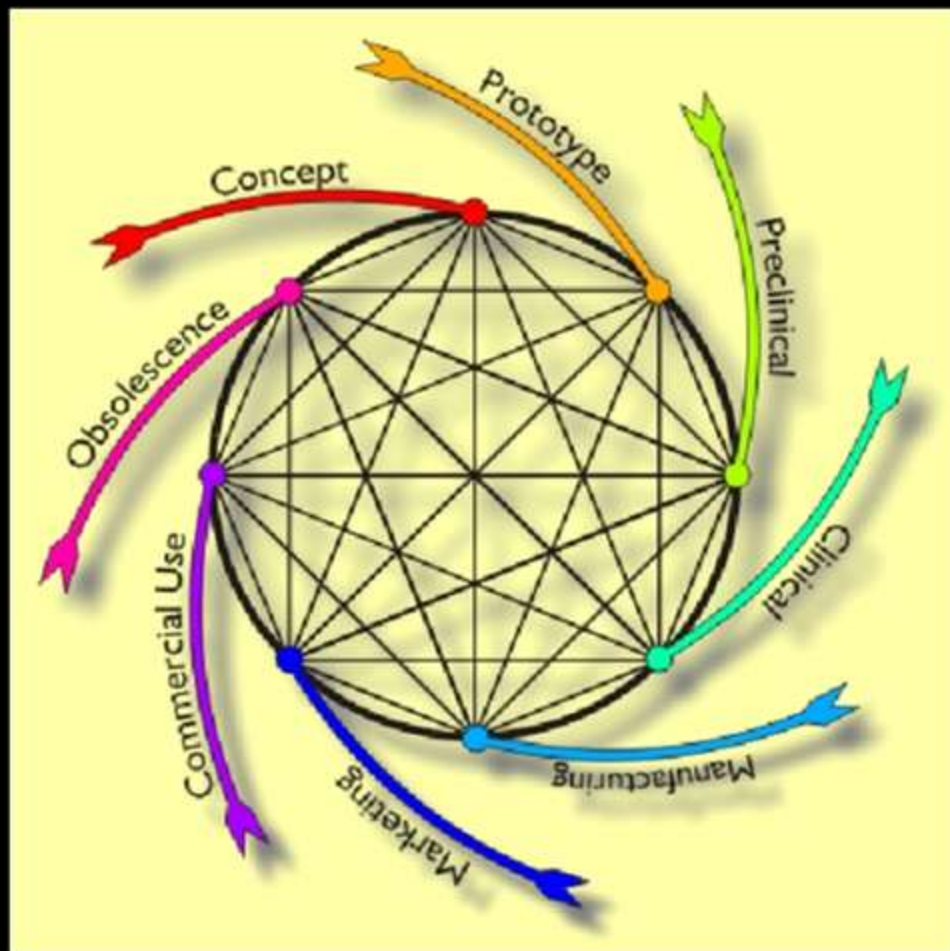
- ▶ Ensuring compliance with orders, standard of care
- ▶ Documentation of care
  - 50 – 75% of healthcare staff time for paperwork
  - Hospitals lose 8-12% of billable items
- ▶ Managing preventable conditions
  - Pressure ulcers – \$11.1B
  - Falls - \$6.6B
  - Medical errors - \$19.5B
  - Other
    - infections, DVT, air embolism, disease management

# Healthcare System Evolution



# Sensor Assisted Care

## From Concept to FDA Cleared VivaTRAK™



### System Components

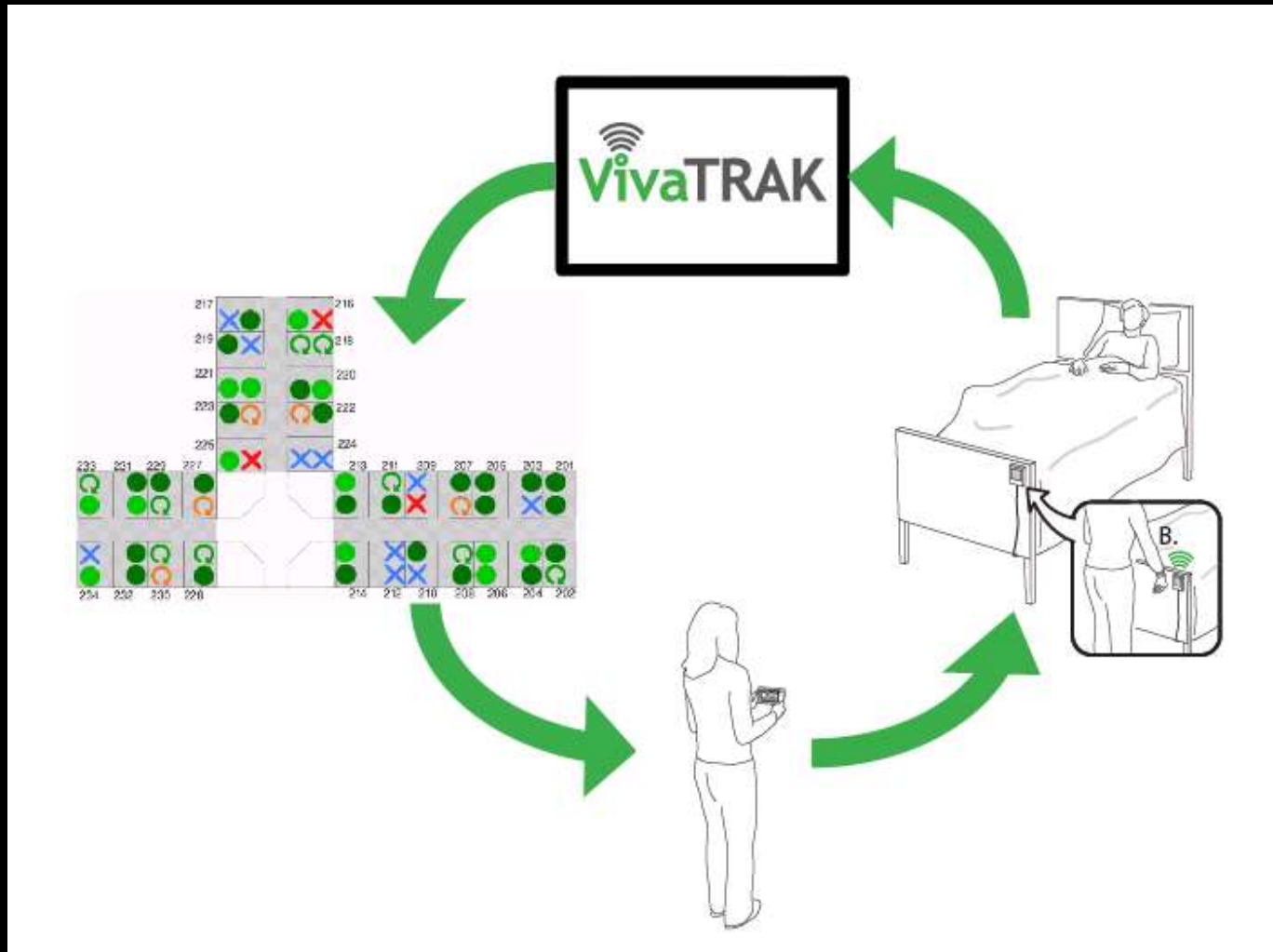
- Sensors related to problem
- System to process & transport
- Present information
  - real time display
  - data for report & EMR

1. Concept – “Smart Bed” (2003)
2. Prototypes (2003 - 2009)
3. Preclinical (2003)
4. Clinical (2007 – 2010)
5. Manufacturing (2010)
6. Marketing (2010)
7. Commercial Use (2011)
8. Obsolescence TBD

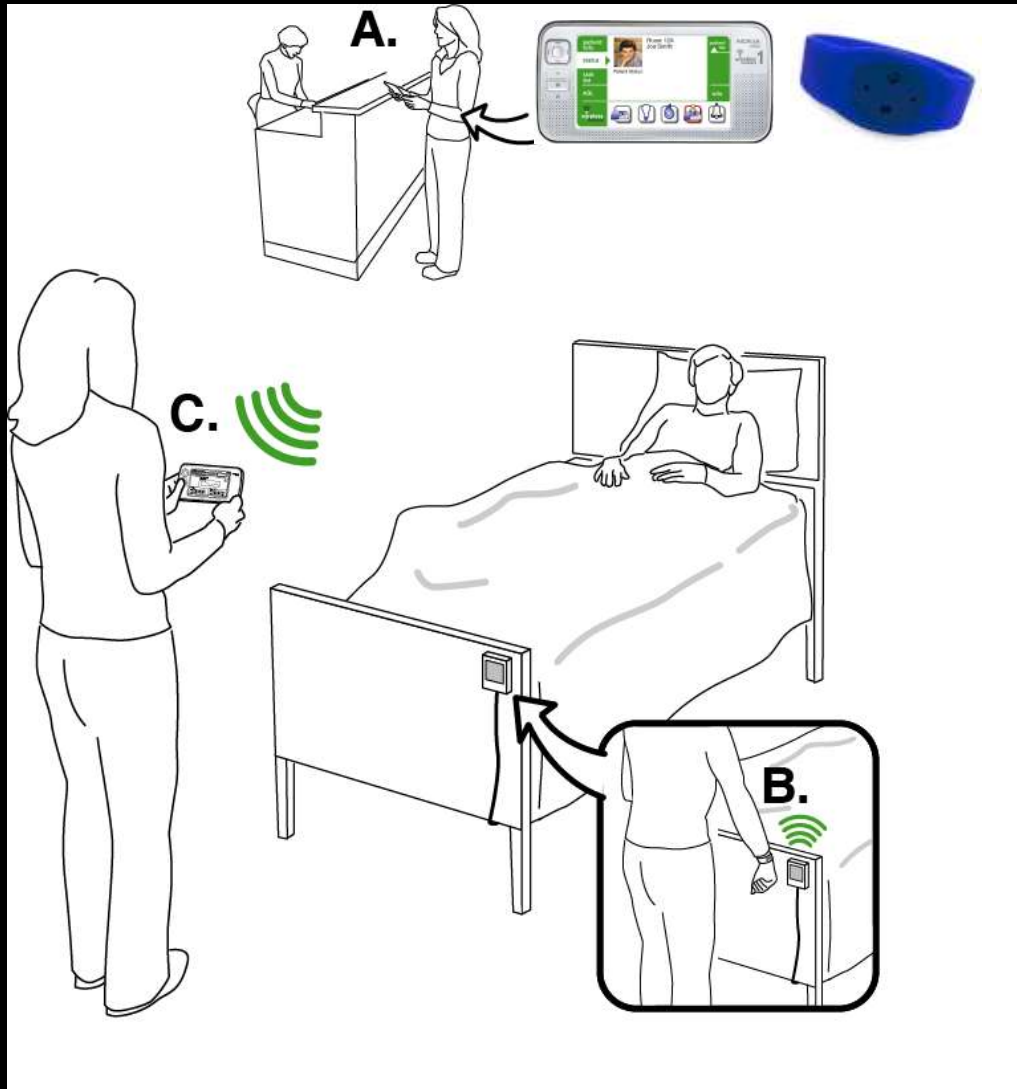
# Reusable & Expandable Sensor Platform

- ▶ New sensor elements
  - MEMS, nanotechnology, chemical
  - Converts physical condition to electrical signal
- ▶ Ubiquitous communications links
  - Personal Area Network (PAN) – Bluetooth, Zigbee, other
  - Local Area Network (LAN) – Wifi
  - Wide Area Network (WAN) – cellular, satellite, fiber, wires
- ▶ Lower power/cost and smaller size processors & memory
  - Embedded computers with “system on chip” processors
- ▶ Secure network and data entry & retrieval
- ▶ All devices connect to network and internet

# Care Task Process Loop



# Facility Work Flow Concept



A. Caregiver begins work shift by obtaining a RFID bracelet and a "handheld terminal"

B. Caregiver enters patient's room and waves RFID bracelet to indicate bedside presence. As a result, the caregiver ID, patient bed ID, and time/date are sent to the system.

C. The system receives the bed and caregiver information and may then serve authorized access to information and prompt the caregiver in completing tasks compliant with the standard of care.

The caregiver performs tasks and enters records either on the handheld terminal or readily accessible fixed location terminals.

Sensors confirm tasks such as "patient turn" have been completed with a secure data messages to electronic medical records, care plan, and accounting.

# Care Automation System – 2007



RFID: Card & Reader



Movement Sensor (under mattress)



Processing Machine  
(hardware, software & comm links)



Handheld Terminal  
(Browser)



Fixed Location Terminal  
(Browser)



Data Server  
Web Page Server

WWW

# Algorithm Development

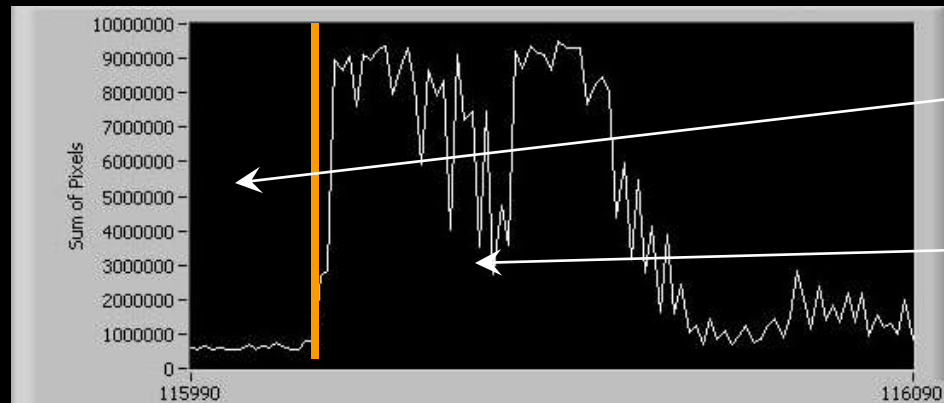
## Collaboration of User & Engineers

- ▶ Sensor provides data
- ▶ Need - define algorithms for processing data into clinically useful information and records



Lab Testing  
by Dutchess

*"Go to bed!"*



Raw data of movement magnitude in time plot



Occupancy  
Status Icons

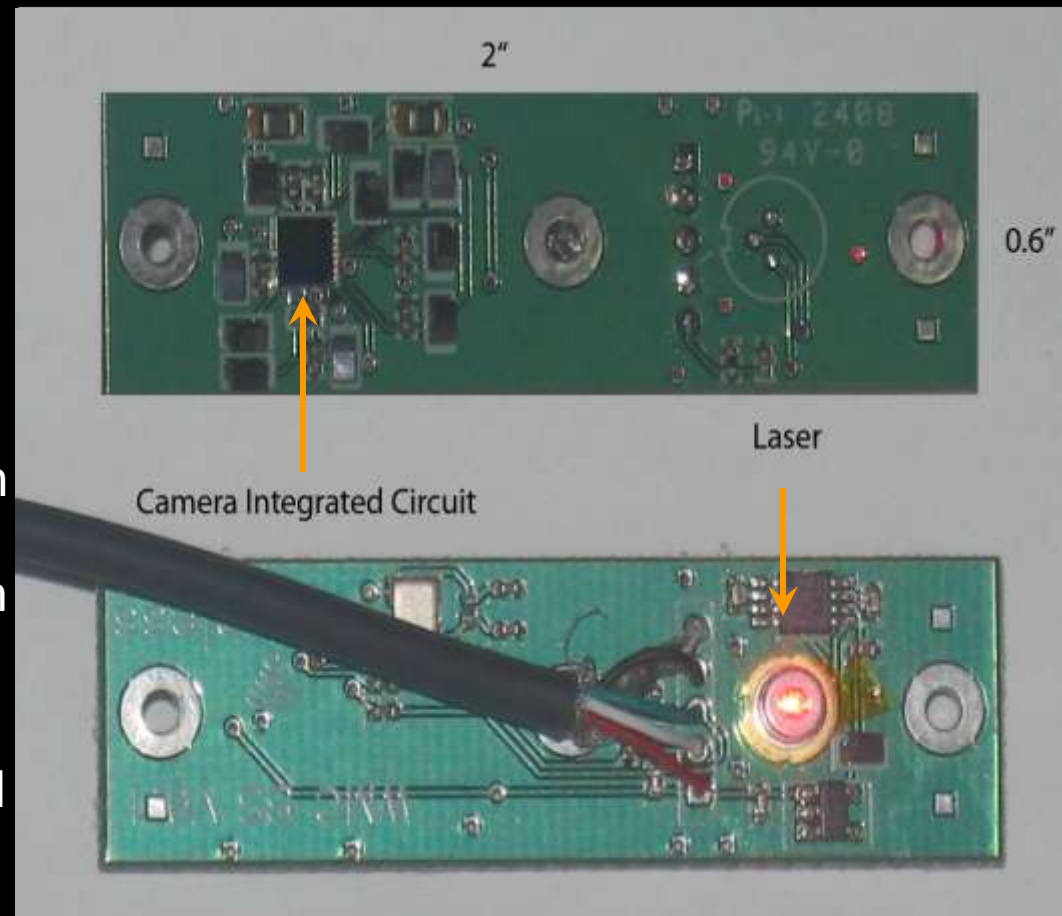
# Clinical Evaluations

- ▶ Carilion Health System IRB
- ▶ 2004: Medical Facilities of America (“MFA”)
  - Salem Health & Rehabilitation – Salem, VA
- ▶ 2007: Traditions Management
  - Carrington Place at Botetourt - Daleville, VA
- ▶ 2008 – present: MFA
  - Raleigh Court Healthcare Center – Roanoke, VA
- ▶ Sensor data from resident bed and presence of caregiver sent to central location for real time status and archiving information
  - June 2009: Response to FDA for 510(k)

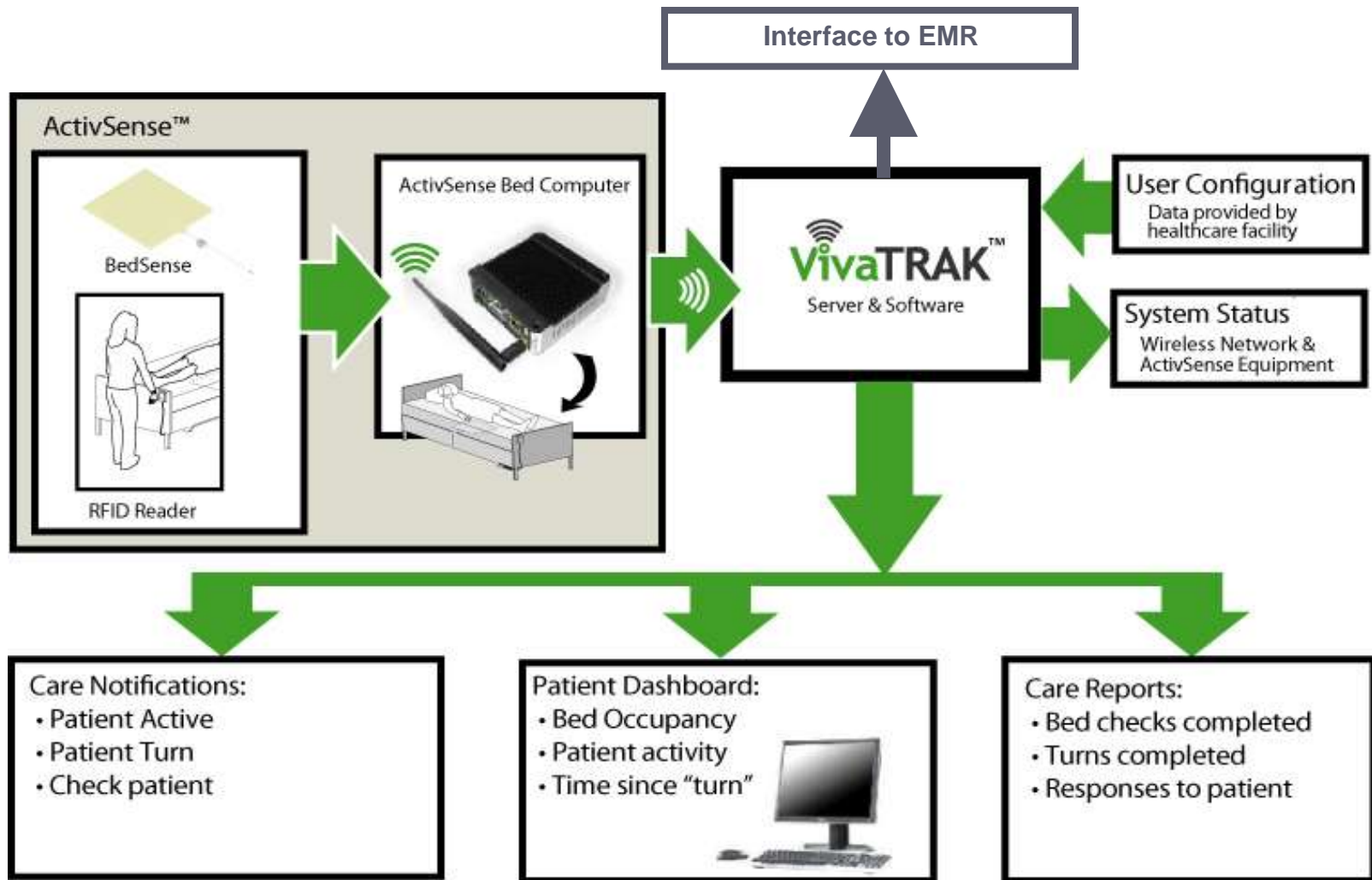
# Virginia Tech Fiber Optic "Movement" Sensor Technology

- ▶ Fiber Optic Sensor
  - Invented at Virginia Tech
  - Senses perturbation caused by movement, data is number
  - Multi-mode optical fiber, laser and camera are components
  - Highly sensitive / Inexpensive
  - Demonstrated in lab tests to detect heartbeat and respiration
  - Wireless data transmission
- ▶ Sensor system detects movement in bed -> occupancy and "large movement" such as patient turn
- ▶ This sensor addresses bed occupancy and movement / related to pressure ulcers and falls.

US Patents 7,189,958 and 7,196,317



# Information Flow in VivaTRAK™



# VivaTRAK Patient Dashboard

The screenshot displays the VivaTRAK Patient Dashboard interface. It features a central floor plan with various icons indicating patient status. To the left, there are two summary tables: 'RESIDENTS OUT OF BED' and 'RESIDENTS TO BE TURNED'. To the right, there is a legend titled 'ICON' that explains the meaning of the symbols used on the floor plan.

RESIDENTS OUT OF BED			
Status	Bed	Resident	Time
✘	207B	Mister Blacke	8:20:14 PM
✘	216	Demo Beta	8:20:14 PM

RESIDENTS TO BE TURNED			
Status	Bed	Resident	Time
🔄	230B	sally sleepy	8:20:14 PM
🔄	220A	Misses Greene	8:20:14 PM
🔄	228A	Authur Donneley	8:20:14 PM
🔄	203A	Betty Corruthers	8:20:14 PM

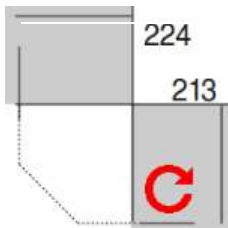
  

ICON	Meaning	Message
●	Idle in Bed	
●	Active in Bed	
✘	Assisted Bed Exit	
✘	Unassisted Bed Exit	Unassisted Bed Exit
🔄	Turn Soon	
🔄	Turn Now	Turn Now
🔄	Turn Late	Turn Late
🔄	Turn Missed	Turn Missed

# Task: Turn for Pressure Ulcer Prevention

## Notification

Icon & messages



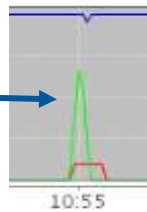
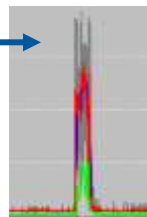
## Care Provided

Caregiver arrives, swipes RFID, and turns patient.

Activity Sensed  
Verifies completion

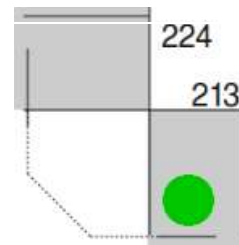


RFID Read  
Caregiver ID & time



## Real Time Status

Icon to OK status



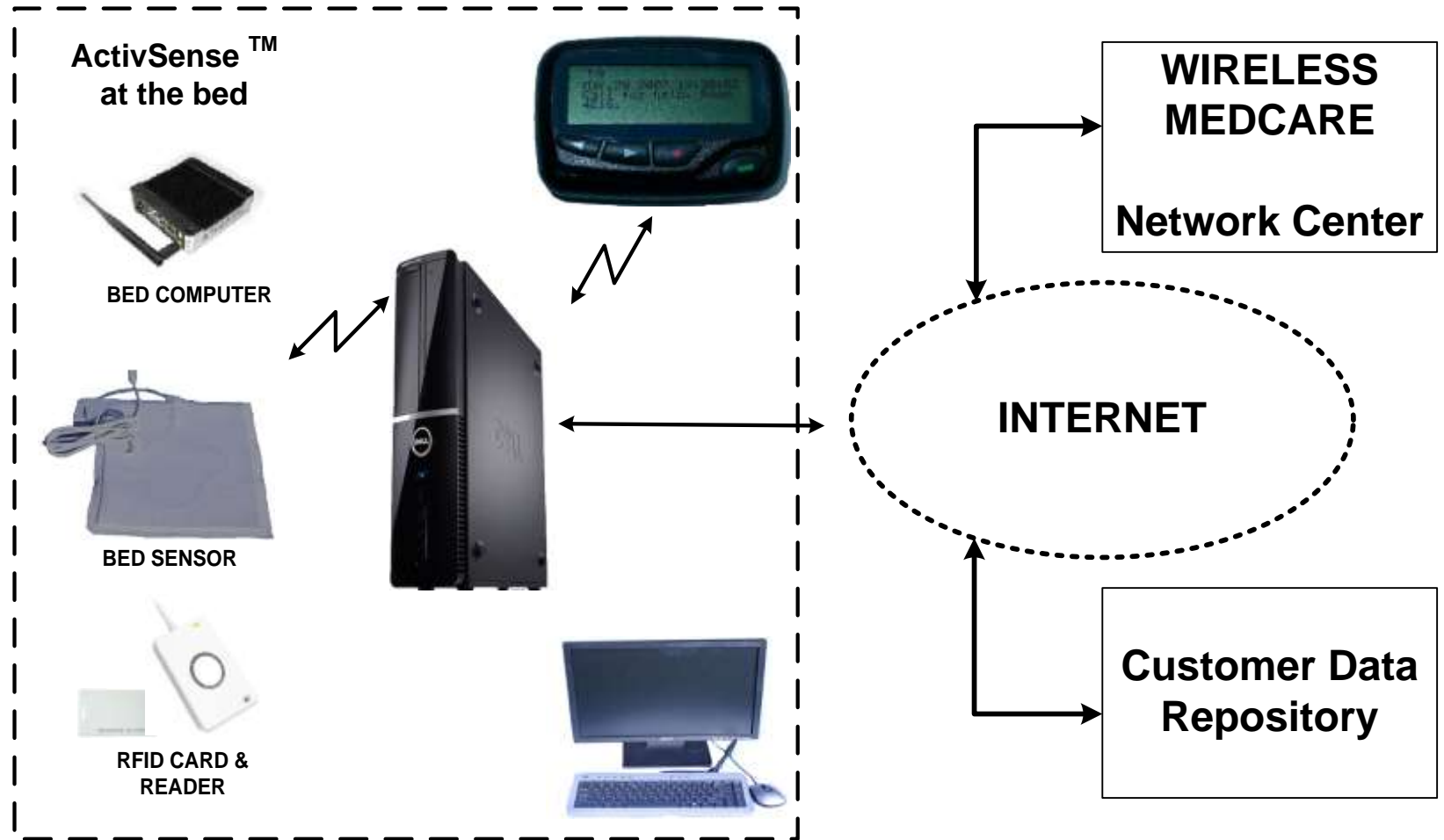
## Electronic Record

Reports of care task completed

Data exchange –  
SQL, Oracle, other

Timestamp	Staff Id	Message	Date
1274710787457	1	TURN	05/24/2010 10:19
1274710965162	0	UNASSISTED BED EXIT	05/24/2010 10:22
1274711281517	1	ASSISTED BED ENTRY	05/24/2010 10:28
1274711489291	0	TURN OVERDUE	05/24/2010 10:31
1274711548771	0	TURN MISSED	05/24/2010 10:32
1274711785509	1	TURN	05/24/2010 10:36
1274712131655	0	TURN OVERDUE	05/24/2010 10:42
1274712182115	0	TURN MISSED	05/24/2010 10:43
1274712320988	1	ASSISTED BED EXIT	05/24/2010 10:45
1274712350105	1	ASSISTED BED ENTRY	05/24/2010 10:45
1274712508135	2	ASSISTED BED EXIT	05/24/2010 10:48
1274712785121	0	UNASSISTED BED ENTRY	05/24/2010 10:53
1274712913222	1	TURN	05/24/2010 10:55
1274713206506	1	TURN	05/24/2010 11:00
1274713248396	1	ASSISTED BED EXIT	05/24/2010 11:00

# Wireless MedCARE's VivaTRAK™ FDA Cleared System



# Looking Forward . . . Repeat Cycle

- ▶ Sensors
  - Wetness, temperature, light, humidity, tilt, acceleration
- ▶ Algorithms
  - Actigraphy, respiration rate, heart rate, awake / sleep
- ▶ Connect to other
  - Medical monitoring equipment
- ▶ Communications
- ▶ SMS, IM, personal EHR

# Invitation to Collaborate

## ▶ Resources

- Patented sensor, Labview software for development of algorithms
- VivaTRAK System
  - ▶ FCC and FDA cleared “computer”
  - ▶ web enabled system, sensors, wireless
- Other intellectual property

## ▶ Activities

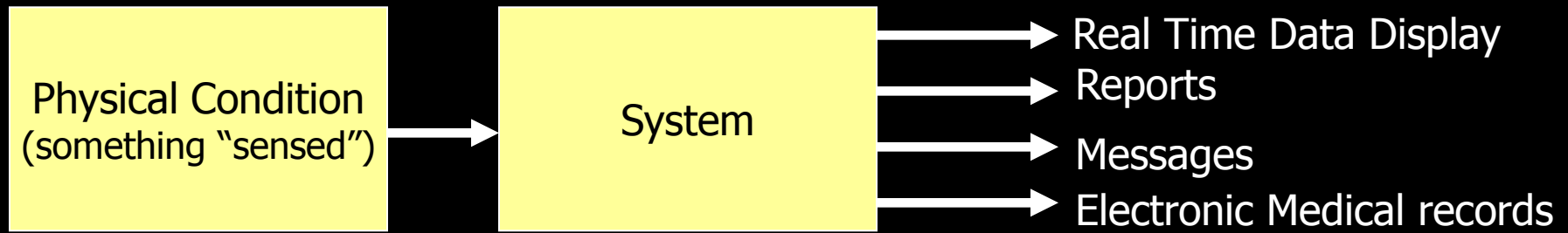
- Grants & research
- Product development

## ▶ Goals

- Efficacy data for pressure ulcers, falls, sleep, other
- Add additional sensors and services to VivaTRAK offering
- Accelerate “sensor assisted care” into the market

*If “it” can be sensed and address a healthcare problem, automation is practical*

# Sensor Assisted Care



- ▶ Technology enable new systems
- ▶ Sensor Assisted Care Platform:
  - electrical signal from sensor to solve a problem
  - Real time actionable information
  - Records for documentation
  - Expandable

# Thank You . . .

Daniel W. Wrappe

CEO

Wireless MedCARE, LLC

[dwrappe@wirelessmedcare.com](mailto:dwrappe@wirelessmedcare.com)

(540) 551-4948

Skype Name: *wrappe*