



# RAJENDRA K SHAH (RAJ)

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## EXPERT INNOVATOR: Energy-efficient home comfort solutions

### Areas of Expertise

- Deep domain knowledge in residential Heating, Ventilating and Air Conditioning (HVAC) systems
- Technology integration, control algorithms, modeling and simulation, data analytics
- Strategic, customer-focused solutions driving sustained competitive advantage and growth
- Cross-functional leadership delivering successful product launches
- Extensive technical expertise related to patents

### Innovations

- [50 patents granted](#), 9 pending, primarily related to residential HVAC systems
- Features benefiting homeowners and service technicians: *energy savings, superior comfort, intuitive user interfaces, simplified installation, diagnostics*

## PROFESSIONAL EXPERIENCE

### AnalyzRS LLC, Principal

2016 -

Consulting, contract and advisory roles in HVAC systems, Internet of Things, data analytics, cloud applications, patent analysis, expert support for patent litigation.

- Expert witness: Honeywell vs Research Products patent litigation case related to HVAC zoned systems (2018-19)

### UNITED TECHNOLOGIES CARRIER CORPORATION, INDIANAPOLIS, INDIANA

1991 - 2016

- **Highlight:** As “Mr. Infinity”, I created vision, strategy and innovations for Carrier’s Infinity® home HVAC system. Launched in 2004, ground-breaking system quickly blew past sales expectations. Fifteen years and multiple upgrades later it continues as Carrier’s highly profitable top-of-the-line residential system.
- Inventor witness: Carrier vs Goodman patent case, including successful jury trial, for enforcement of one of my Infinity® patents.

### Engineering Fellow, Systems and Controls (2008 – 2016)

One of first eight Fellows selected to Carrier’s top engineering position from thousands of engineers worldwide.

#### Product advances

- [Infinity® Touch Control](#) with internet connectivity launched in 2012. Received Dealer Design Gold award from industry magazine ACHR News in 2013. I was interviewed for July 2013 ACHR News article.
- Led advanced team to develop data-driven home energy models to provide homeowners with simulated predictive estimates of the energy impact of various comfort settings – for Infinity® and thermostats.

#### Leadership, strategy, methodology

- Provided leadership, domain knowledge guidance, architectural inputs and algorithm logic to system and software engineers for Infinity®, thermostats and HVAC equipment. “Go-to expert” for field issue resolution.
- Accelerated development and increased software robustness utilizing simulation model-based Graphical User Interface and control algorithm design as well as field data acquisition and analysis techniques.
- Worked with legal team for patent landscape assessments and patent analysis.

#### Government agency interaction

- Participated in series of Environmental Protection Agency workshops to develop methods to qualify internet connected thermostats for Energy Star rating.
- Worked with California Energy Commission on home air flow certification methodology.



**UNITED TECHNOLOGIES CARRIER CORPORATION (continued)****Engineering Manager, Systems Development (2000 – 2008)**

- Managed 10 development engineers. Designed premium air conditioners, heat pumps, indoor fan coils, advanced thermostats, multi-zone controls and indoor air quality products. Multiple product launches resulted in sustained growth in unit sales and profits.
- New technologies incorporated included inverter driven compressors, advanced brushless DC variable speed fan motors, germicidal air purifier and many new control algorithms. A number of patents were granted for these improvements.
- Infinity® system, highlighted above, was developed by my team and launched in 2004 with great market success. Completely new system architecture, communicating and self-configuring controls and excellent functional integration among installed equipment enabled a set of sophisticated features (many patented) that were nevertheless easy to use, install, set up and service.

**Senior Program Manager, Advanced Systems (1991 – 2000)**

- Pioneered the launch of new product categories for Carrier, including two stage air conditioners & heat pumps, variable speed fan coils, digital thermostats, multi zone controls, expandable filters and fresh air ventilators. Led a group of eight engineers. New product lines achieved enthusiastic market acceptance, drove sales growth and set the stage for future breakthroughs.

**ADDITIONAL RELATED EXPERIENCE****GENERAL ELECTRIC GE MOTORS (now REGAL)****Project Manager, Electronically Commutated (Brushless DC) Motors**

Introduced GE's new line of brushless DC variable speed motors targeted at residential heating and air conditioning applications. One highlight was motor's built-in capability to control air flow delivered through home duct system independent of variations in duct restriction. My patent for this feature was part of enforcement litigation and, as the inventor, I was extensively deposed.

**UNITED TECHNOLOGIES ELECTRONIC CONTROLS****Project Engineer, Control Design**

Designed high volume electronic controls, including electronic circuit design and microprocessor software, for appliances and heating and air conditioning systems.

**EDUCATION**

BS Electrical Engineering, Indian Institute of Technology, Bombay, India

MS Electrical Engineering, Ohio State University, Columbus, Ohio

MS Business Administration, University of St Francis, Fort Wayne, Indiana

**PERSONAL**

US citizen, married