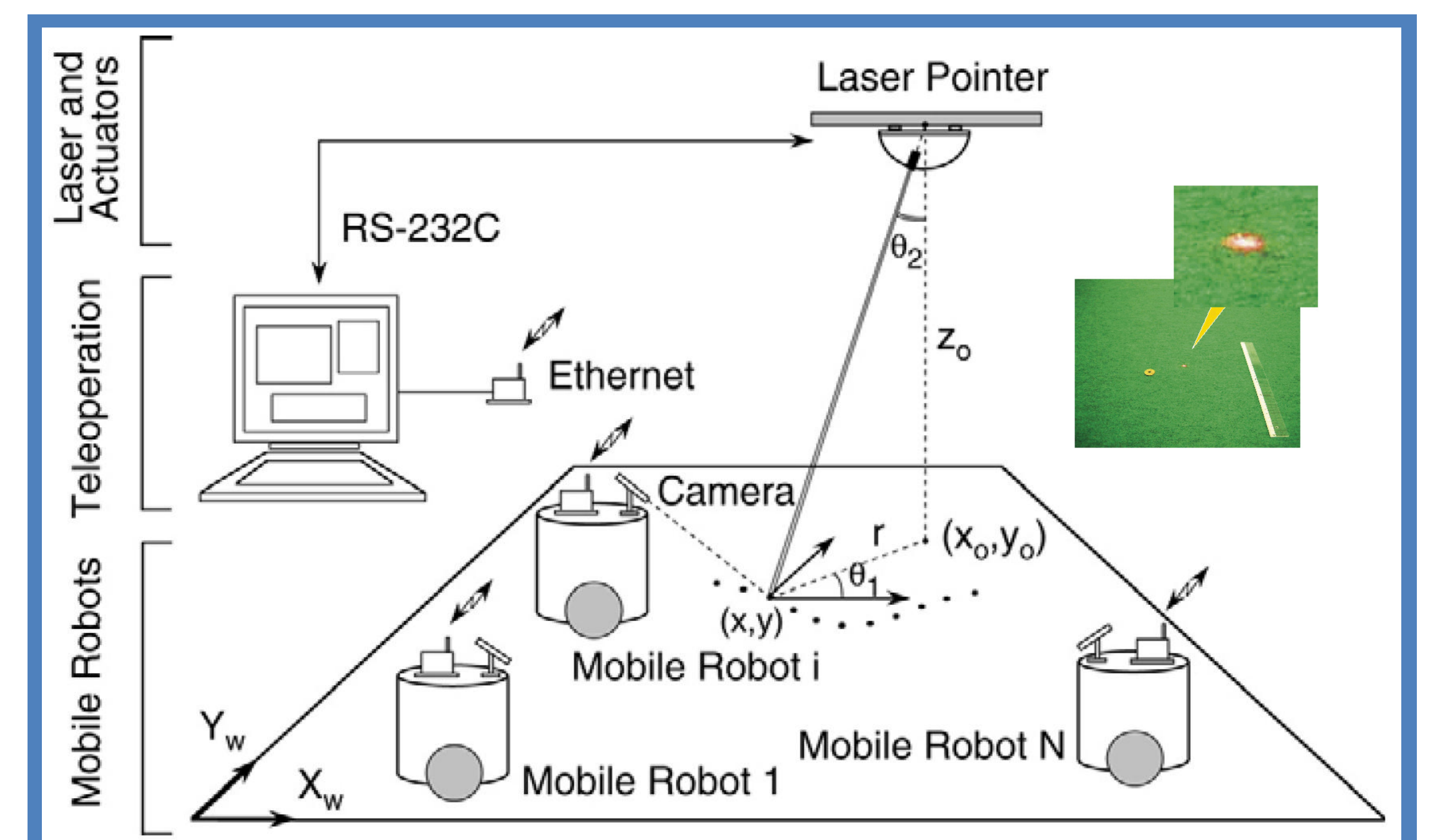


# Optical guidance of robots: method and system

U.S. Patent 6,629,028

## Objective: improve guidance accuracy of robots by means of laser light projection, image processing and communication

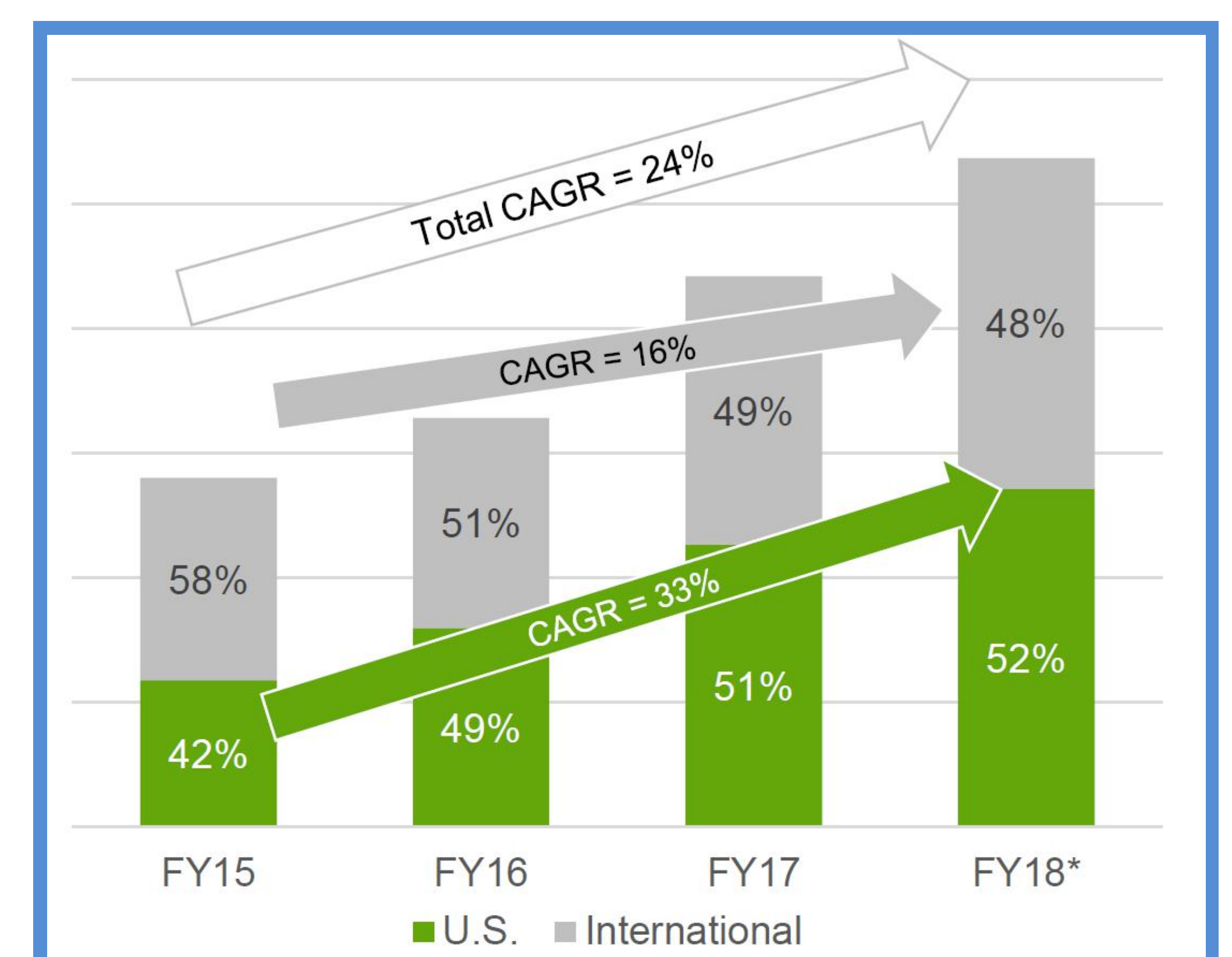
- Key idea: show goal positions to a robot optically instead of communicating them numerically
- Simplify directing a robot by using an intuitive interface
- Increase the accuracy of guidance by using a visual feedback and avoiding an error accumulation
- Allow for an implicit localization of robot
- Serve as a mediator for multiple robots
- Span areas of robotics, computer vision, user interface, communication and smart home technologies



## Key statistics by iRobot:

- \$1.73 billion global robotic vacuum cleaners market including \$629 million spent in the USA in 2017
- 23% share of robotic vacuum cleaners in the global vacuum cleaners market in 2017
- 33% CAGR of U.S. revenue by iRobot over the period from 2015 to 2018
- iRobot shipped 3.698 million units globally and reported \$884 million revenue with 34% YoY growth and 49% gross margin in 2017

## iRobot revenue:



## Samsung POWERbot™ with Point Cleaning™:

- Commercial use of optical guidance technology in robotic vacuum cleaners since 2014
- POWERbot™ can be purchased on Samsung.com for \$999 since 2015, 126 million U.S. households in 2016



## Competing innovative products:

- iRobot Roomba® 980 (\$899)
- Samsung POWERbot™ R9250(\$999)
- LG Hom-Bot™ Turbo+ (\$999)
- Neato Robotics Botvac™ D7 (\$729)
- Dyson 360 Eye™ (\$999)
- Ecovacs DEEBOT™ OZMO™ 930 (\$599)

*iRobot's \$ share of U.S. robotic vacuum cleaners market is estimated at 85% with \$452.3 million revenue reported in 2017 according to NPD and iRobot*

## Forecast:

- Rapid growth from \$981 million in 2013 to \$2.6 billion by 2020 for robotic vacuum cleaners worldwide because of automated process and effective cleaning power (by ReportsnReports.com)
- U.S. residential robotic vacuum market to grow at CAGR of 6.43% and 4.45% in terms of revenue and unit shipment, respectively, over the period 2014-2019 (by TechNavio)

**Research article:** "Optical guidance method for robots capable of vision and communication" in *Robotics and Autonomous Systems*, Vol. 54, No. 6, Elsevier, 2006, pp. 461-471.

