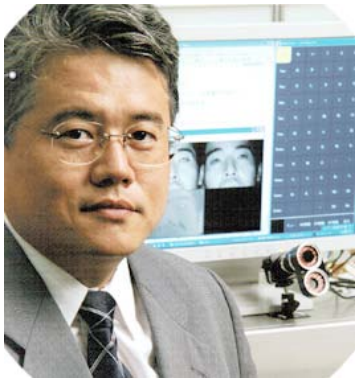
National University Corporation
Shizuoka University
http://www.shizuoka.ac.jp/

UNIVERSITY RESEARCH & ENTREPRENEURSHIP SYMPOSIUM 2010

April 1st

Eye-Gaze Detection System

Screening for Autism in Infants



Inventor

Prof. Yoshinobu EBISAWA, Ph.D

Faculty of Engineering,
Shizuoka University

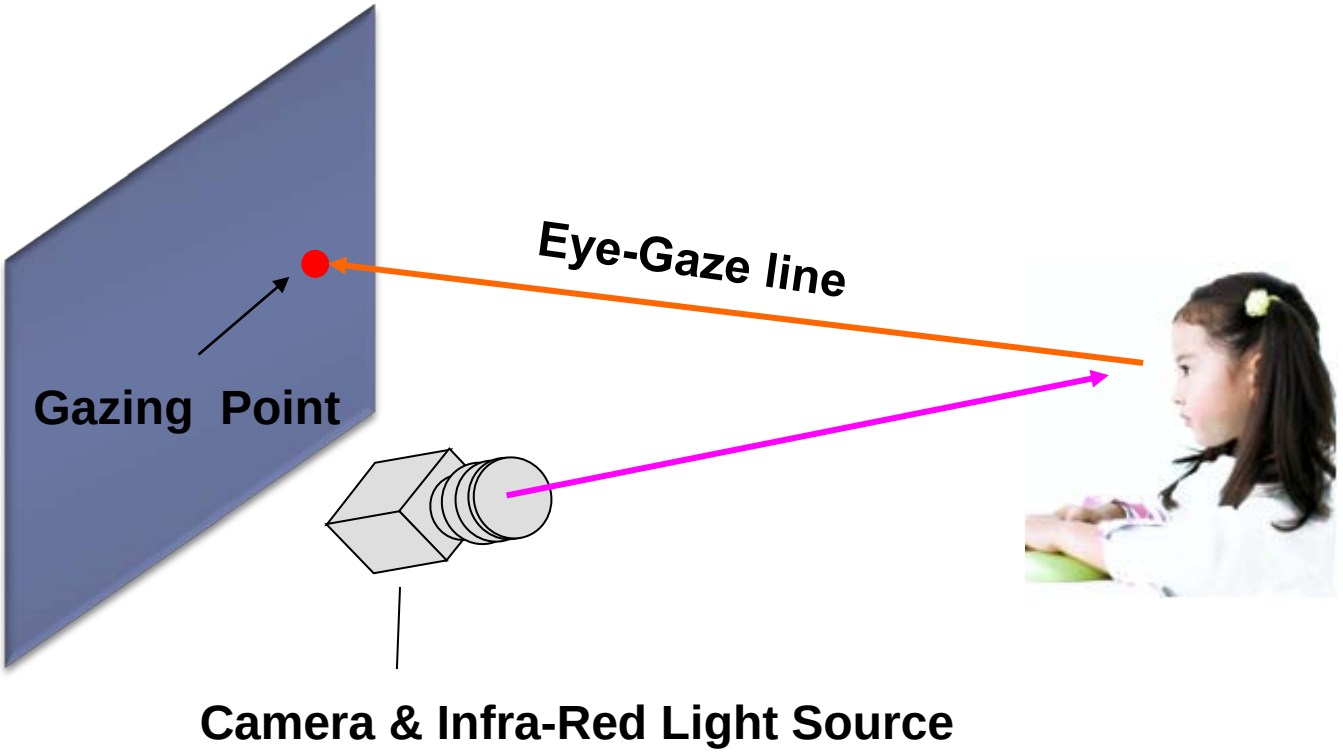
Presenter

Mariko AGATA, Scientific Researcher,
Intellectual Property Office,
Shizuoka University

Eye-Gaze Detection System

is based on Technology of

1. **Detection for Exact center point of Pupil**
2. **Detection for Accurate Corneal reflected point by Robust method and apparatus.**



Market Opportunity

Market Goal

Make it a standard Autism Screening System
in medical checks
for infants of 1 and a half years old

Market Potential

Establishment of an Operation System
to Start as a Business

Bringing Into Market

- 40% of infants w autism wait for more than 3 yrs for clear diagnosis
- Autism research funding from NIH is about $100M
- 1/150 children in the US, approx 1.5M Americans are Autism
- Rate for autism globally was 0.6%, 4.3M people
- Autism population is expected to increase from 4.3M to 7M b/w 2009-2015
- Significant increase of new born autism population in last 10 yrs

about Autism

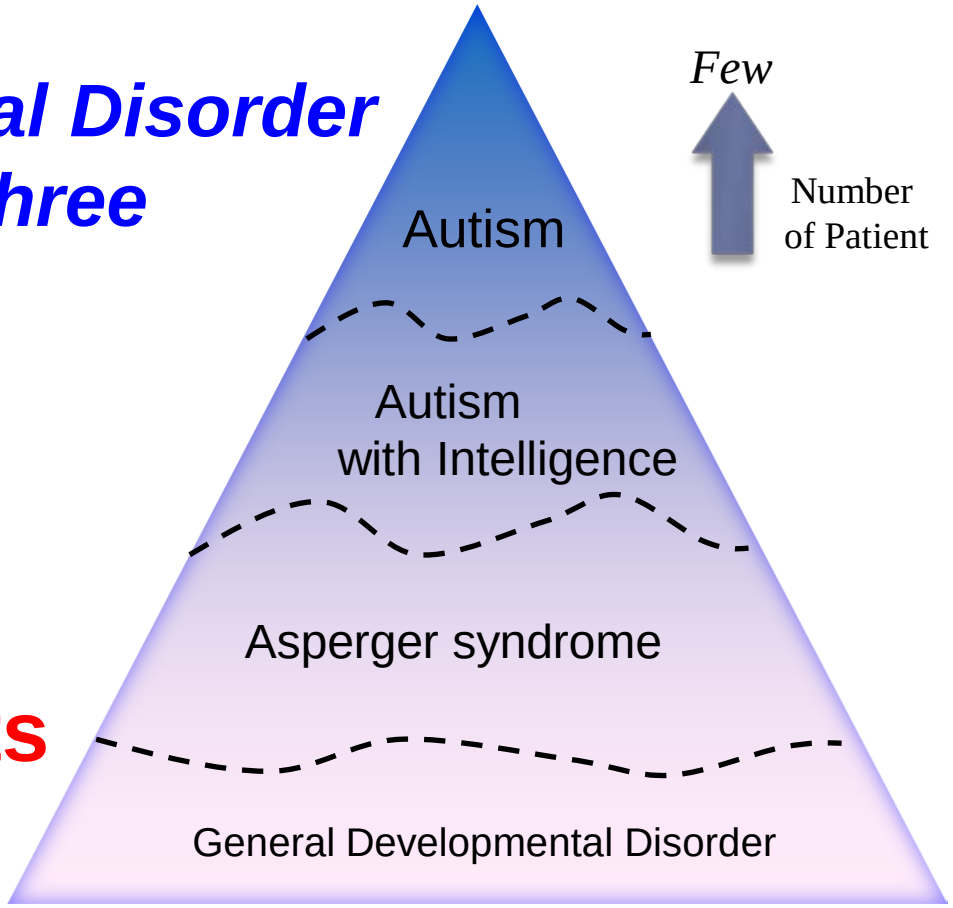
A Lifelong Developmental Disorder Starting Before Age of Three

Triad of Impairments

Difficulty with Social

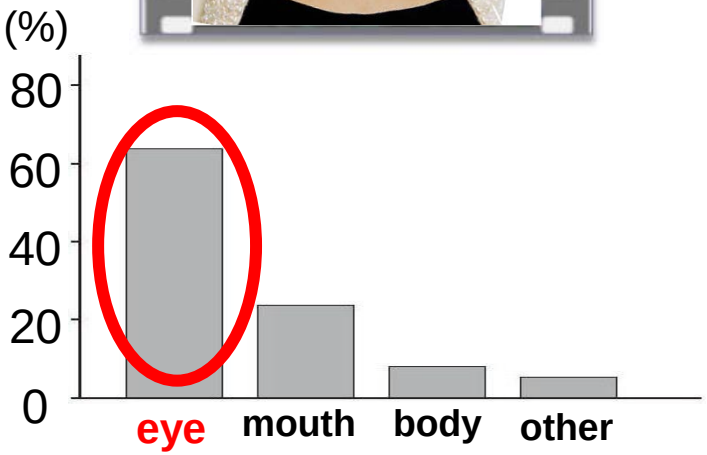
- **Communication**
- **Interaction**
- **Imagination**

Avoiding eye contacts

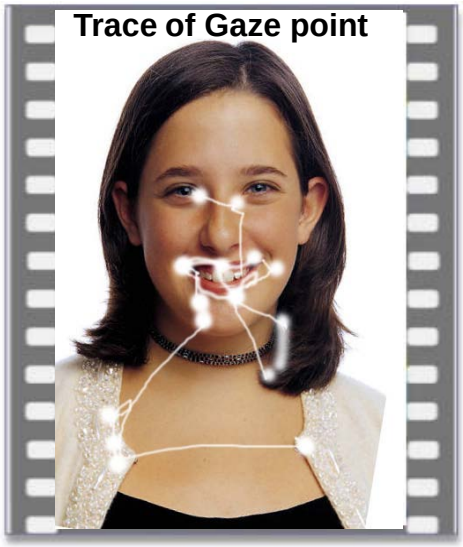


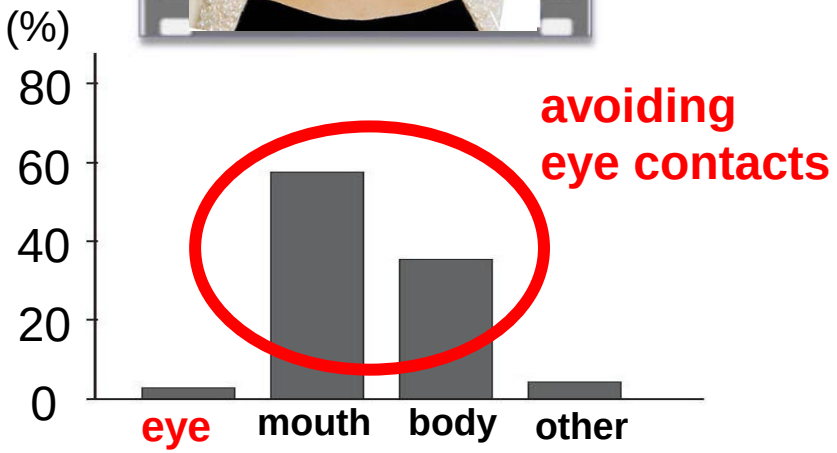
Autism and Related disorder

about Autism (continued)



person without Autism





person with Autism

Core Technology: Detection of the Center of Pupil

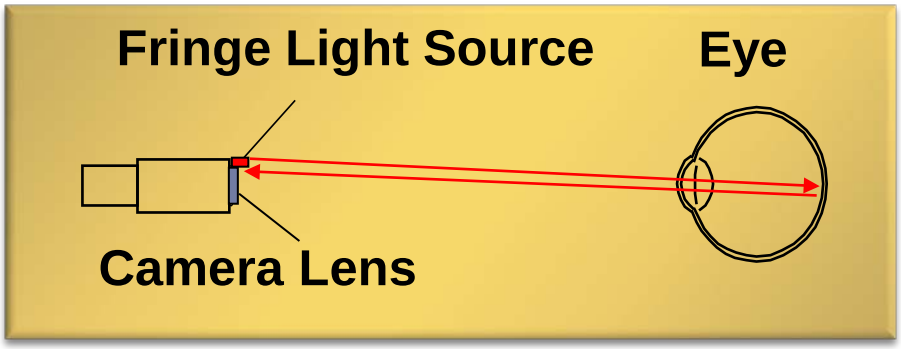
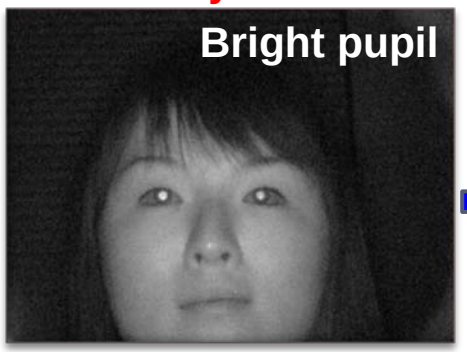
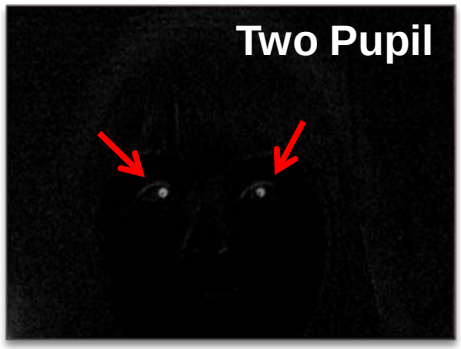


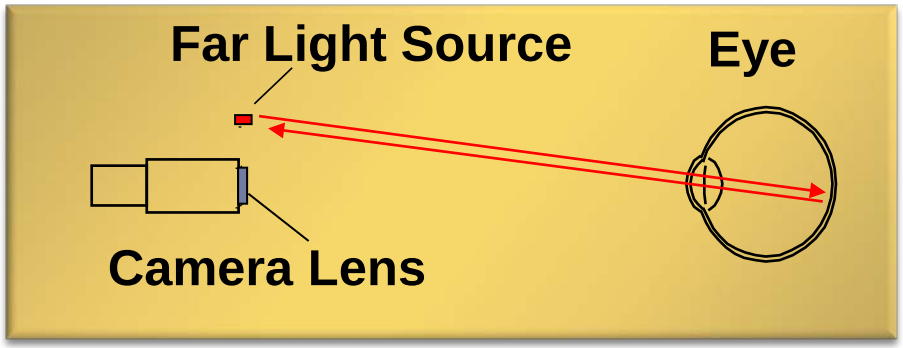
Image with Red Eye Effect

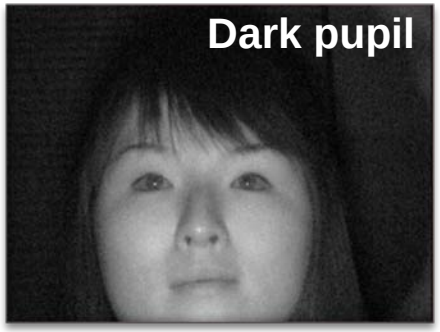




Calculated Differential Image

Robust and precise pupil center detection





US Pat. 7533989, 2009-0219386(pending), and others; EBISAWA / Shizuoka Univ.

Eye-Gaze Detection Demo. w/ 2 cameras

Pupil detect

Center of pupil

Reflected point from corneal

Eye gaze vector

Measuring accuracy

Demonstration movie 17sec

Problems with Existing Eye-Gaze Detection Devices

Competitors are Strong?

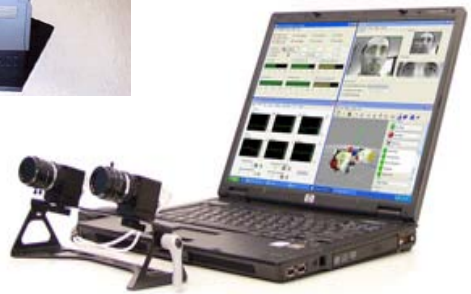
Other Device

- More preparation needed
- Incapability of tracking head movement
- No software specialized in screening for autism
- Expensive (may be ~$50K)

Not the Best Devices for Infants Autism Screening

ISCAN Inc.
Woburn, MA 01801 USA

Tobii Technology AB
Stockholm, Sweden
/ Dedham, MA 02026 USA



Seeing machines Inc.
Acton, MA 01720 USA

Our Solution

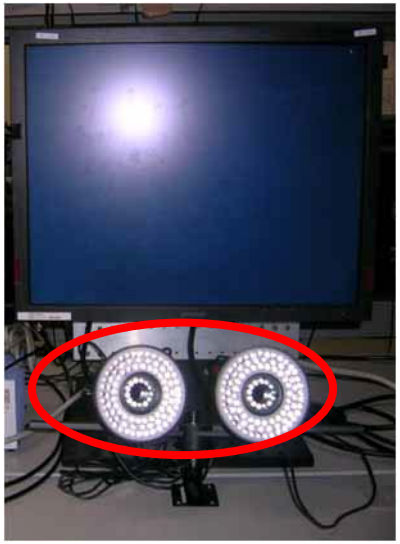
- **No need of calibration and preparation** ★
- **Free to head movement on detecting** ★
- **High accuracy, High speed, Real time**
- **Software specialized in screening for autism**
- **Not expensive** (possible to ~$5K in mass production)

Potential Applications

Vision testing for healthcare

High precision 3-Camera system use for Autism screening

Human performance measurement



2-Camera system use for general

Sports

Robotics

Security

Small 1-Camera unit use for Cockpit

Entertainment

Driver safety

Install to the Cockpit of a track

This technology is protected by over 30 patent application filed in Japan, US, and WIPO

Cost

	(Number of products/ 1 rotation)		Estimation
Main parts	Cost/ unit (10Units)	Cost/unit (1,000Units)	Proto-type Development
Control Unit (Micro PC)	$1,000	$120	$3,000
Display	$400	$350	$800
Infra-Red irradiation 3Unit	$3,000	$100	$80,000
3-Cameras	$750	$300	$2,400
Total Cost	$5,150	$870	$86,200

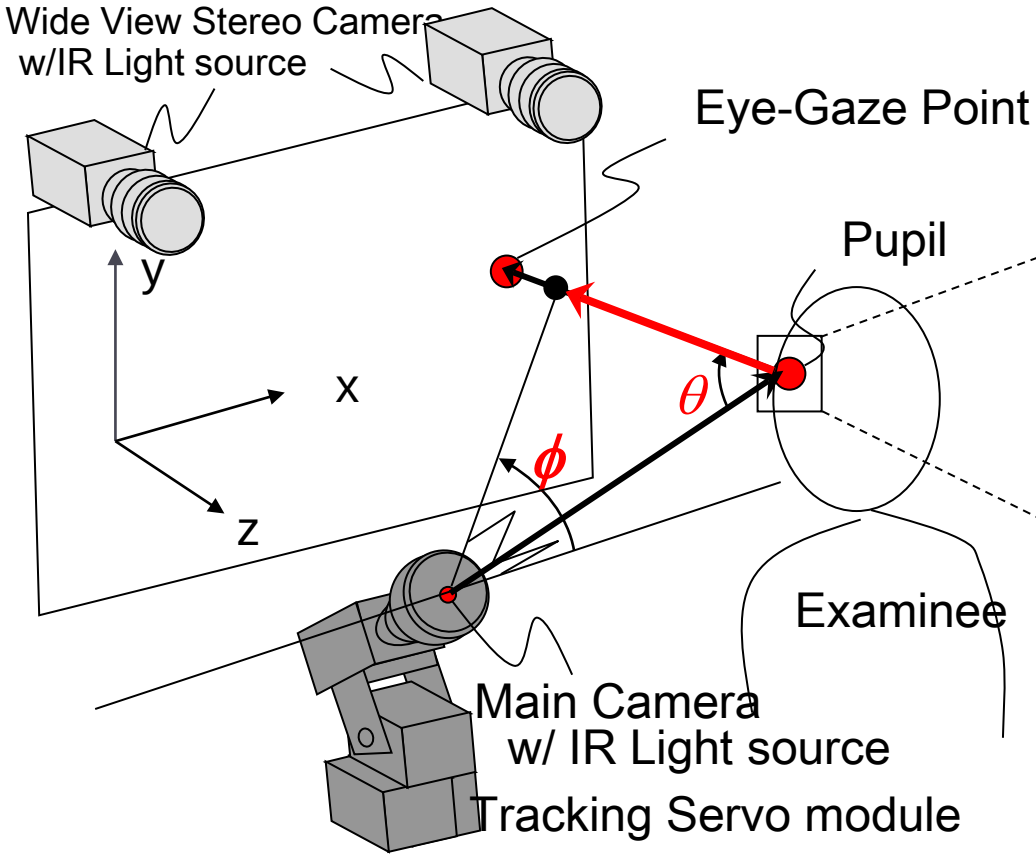
Next steps

1. High Usability with Simple Preparation and Short Screening Time
2. Developing for Cost Down with System Optimizing
3. Optimizing/Costuming of a Software Specialized in Autism Screening

Mt. FUJI in Cherry blossoms from our campus

The following pages are appendix for Q&A

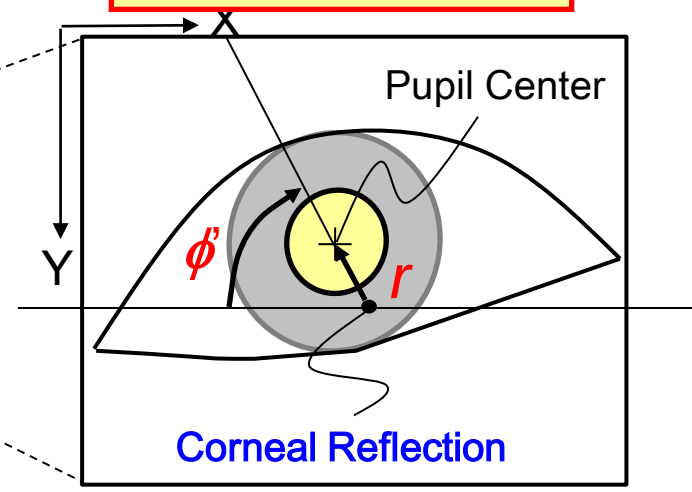
Core Technology : Detecting Accurate reflected point from Corneal

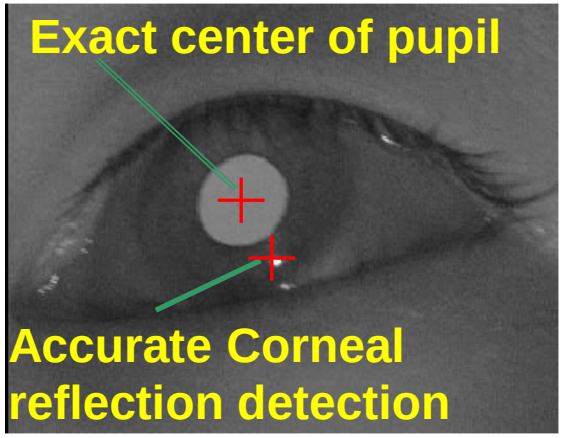


Eye-Gaze Detection System

Invention

$$\phi = \phi', \ \theta = k\,|r\,|$$





Main Camera Image

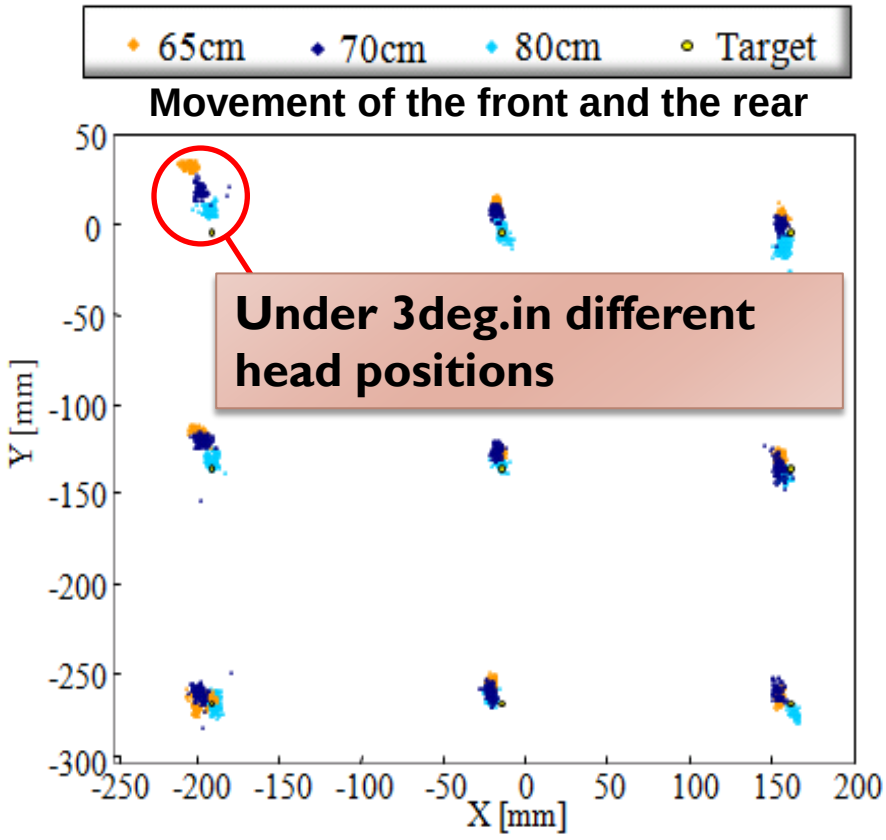
US Pat. 7,533,989 (Appl. Dec.24,2004)
"Sight-line detection method and device, and three-dimensional view-point measurement device";
EBISAWA / Shizuoka Univ.

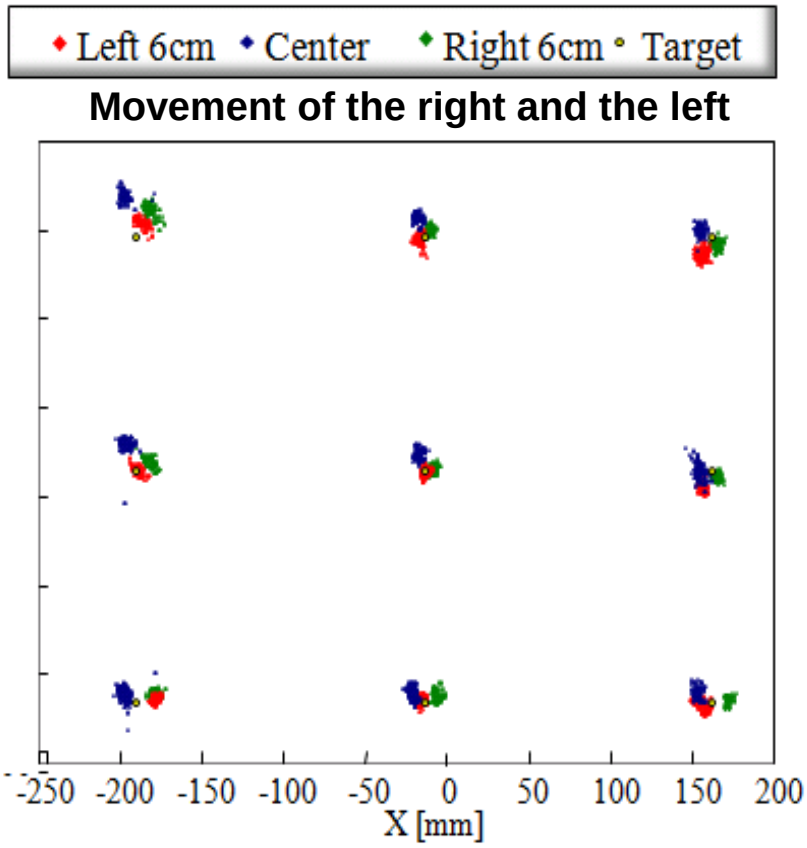
Appendix

Result of Eye-Gaze Detection w/ 3 cameras

◆An examinee keeps one's eyes on points placed 3 by 3 on a display.

◆Eye-Gaze is detected when the head of examinee is moved to the front, rear, right, and left.





There is not much differences in the result of eye-gaze detection with head movements of 12-15cm.

Appendix

The eye-gaze detection system can detect the state of sleepiness of a driver with high efficiency even at night.

Drowsiness detect system tested on the drive simulator

Small camera unit was test on a truck

Appendix

Summary

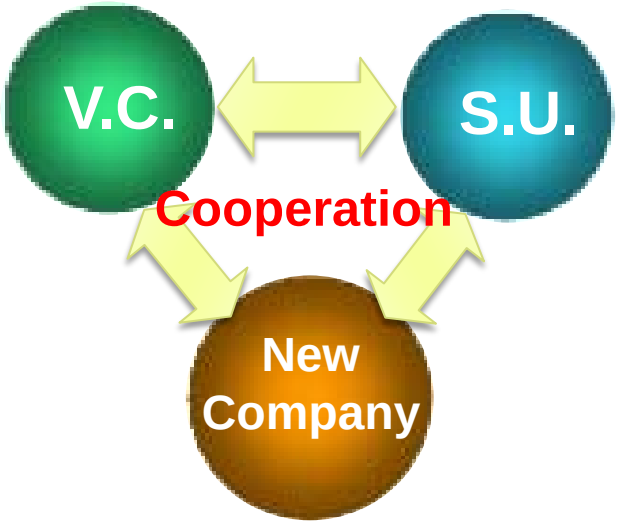
Proving the Potential of Eye-Gaze Detection

Development of High Quality Screening System

Standardizing System
Low Price for Wide Distribution

Early Detection
- Early Intervention & Therapy
- Potential Ability
- Lower Stress for Parents

Social Contribution



Appendix