GRID-EYE
INFRARED ARRAY SENSOR
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AGENDA

- Introduction
  - What is GridEYE?
  - How does it work?
  - GridEYE Advantage/Comparison
  - Targeted Applications
  - Example Applications
  - GridEYE Video

- Product Details
  - Component & Function
  - Product Specification
  - Effective Detection Distance

- Summary
INTRODUCTION
WHAT IS GRIDEYE?

Overview
- GridEYE is an 8x8 (64) pixel infrared array sensor.
- It uses an array of thermopile to measure actual temperature as well as temperature gradients.
- It comes with a built-in lens with 60° viewing angle.
- It is a high precision compact SMD design using MEMS technology.

Features
- Based on thermopile technology, GridEYE can detect the direction of moving people and objects – up, down, left, right and diagonally.
- Its coordinated array of sensing elements can even detect multiple people or objects moving in different directions.
- At close proximity, Grid-EYE is even capable of detecting hand movements for simple gesture control.

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HOW DOES IT WORK?

- New sensing options compared to conventional sensor device
- Multiple elements measure the temperature of each area

Temperature measurement

- Human body wavelength 10um range
- Infrared Array Sensor
- $8 \times 8 = 64$ pixels
- Thermal image
GRIDEYE ADVANTAGE/COMPARISON

<table>
<thead>
<tr>
<th></th>
<th>Moving object</th>
<th>Motionless object</th>
<th>Movement direction</th>
<th>Temperature measuring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pyroelectric</td>
<td>Possible</td>
<td>Impossible</td>
<td>Impossible</td>
<td>Impossible</td>
</tr>
<tr>
<td>Thermopile (Single element)</td>
<td>Possible</td>
<td>Impossible</td>
<td>Impossible</td>
<td>Impossible</td>
</tr>
<tr>
<td><strong>Grid-EYE</strong></td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
<td>Possible</td>
</tr>
</tbody>
</table>

- A lot more functionality as compared to Pyro-electric and Thermopile.
- Above extended features of GridEYE make it possible to be used in a wide variety of applications.
- GridEYE is the latest technology of sensor products available in smallest size in market today.
TARGETED APPLICATIONS

- Home Appliances
- Area Monitoring
- Ambient Assisted Living
- Hot Spot Detection
- Industry Safety & Control
- Safety and Security
- Gesture Control
- Consumer Comfort
- Energy Saving
AIR CONDITIONER APPLICATION

- Detection of temperature distribution for optimal temperature control

- Comfort – Regularize room temperature
- Saving Energy – Control temperature of necessary areas

<table>
<thead>
<tr>
<th>Detected Temperature (degC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>29 29 29 28 28 28 28 28 28</td>
</tr>
<tr>
<td>29 29 28 28 28 28 27 28 27</td>
</tr>
<tr>
<td>29 29 28 28 28 27 27 26 26</td>
</tr>
<tr>
<td>29 29 28 28 27 27 26 26 26</td>
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<td>29 28 28 28 27 26 26 26 26</td>
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<td>29 28 28 28 27 26 26 26 26</td>
</tr>
<tr>
<td>29 28 28 28 27 26 26 26 26</td>
</tr>
<tr>
<td>29 28 28 28 27 26 26 26 25</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Air conditioner for vehicle</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 30 29 27</td>
</tr>
<tr>
<td>29 28 26 25</td>
</tr>
<tr>
<td>25 24 23 23</td>
</tr>
<tr>
<td>22 22 22 21</td>
</tr>
</tbody>
</table>

Hot Area
Cold Spot
Detect human occupation and room Temperature

- Convenience – Avoid food being too hot.
- Saving Energy – Only heat up necessary area
HOT SPOT DETECTION

- Detect hot spots in critical industrial areas e.g. Circuit breakers

Functionalities: hot spot detection (permanent monitoring)
- Pre-alarm / alarm: crossing of pre-defined threshold $T^\circ$ values
- Hot spot localization
- $T_{\text{max}}$, Surface of the hot spot
Innovation for Cold Chain Business in Japan

- Collaboration Between Nittsu and Mars Company

Transportation Tuna Fish with Snow Ice

Temp: -1.0°C  Salt Density: >1%

Snow Ice  Normal Ice

Grid EYE

Innovation for Cold Chain Business in Japan
Grid-EYE Unit

- Panasonic Product
- 4 Grid-EYE Sensors
- In production and commercialized in Japan
- Used to achieve Zero Energy Building
- Used to control lighting and Air conditioning
Grid-EYE Unit – Zero Energy Buildings

Control of Lighting and Air Conditioning by utilizing the information from Grid-EYE unit.
(Number of people, position, moving direction, and Temp information)

- Grid-EYE Unit
- PLC
- Lighting Controller
- A/C Controller
- Server
- Data Analysis
- Transition Monitoring
  - Number
  - Position
  - Temp

Occupant: 100% Brightness
Vacant: Dimming or OFF

Occupant: Turn Up
Vacant: Turn Down
Only Grid-EYE can detect Temperature, and be used for control of both Lighting and Air Conditioning.

<table>
<thead>
<tr>
<th>Detection</th>
<th>Grid-EYE</th>
<th>PIR</th>
<th>Camera</th>
<th>Camera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company</td>
<td>Panasonic</td>
<td>Panasonic</td>
<td>Panasonic</td>
<td>Company – A</td>
</tr>
<tr>
<td>Area</td>
<td>3.6 m × 3.6 m</td>
<td>Φ 4.9 m</td>
<td>7.2 m × 7.2 m</td>
<td>7.2 m × 7.2 m</td>
</tr>
<tr>
<td>Number</td>
<td>YES (8 People)</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Standing-Still</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Position</td>
<td>YES (4 × 4)</td>
<td>NO (Only Occupancy or Vacancy)</td>
<td>NO (Only Occupancy or Vacancy)</td>
<td>YES (2 × 2)</td>
</tr>
<tr>
<td>Temp</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Privacy Protection</td>
<td>YES</td>
<td>YES</td>
<td>Intermediate</td>
<td>Intermediate</td>
</tr>
<tr>
<td>Energy Saving</td>
<td>27.0 %</td>
<td>3.5 %</td>
<td>10.7 %</td>
<td>10.7 %</td>
</tr>
</tbody>
</table>
Grid-EYE is most effective sensor for Energy Saving!

Saving Energy: ▲27% (Occupancy rate 50%)
Components and functions

Grid-EYE Sensor

Silicon lens
- Image formation

Mixed signal processing IC
- 64-Pixels signal readout
- Analog amplification
- Analog to Digital conversion
- Sensitivity correction
- Correction for temperature effects
- Digital communication

Ceramic package
- Air tightness
- Radio shielding
- Possible to use with Reflow soldering

IR detector
- 8 x 8 pixels
- Thermal insulation structure using MEMS technology
- Infrared absorption
- Thermoelectric conversion
## PRODUCT SPECIFICATION

### Can package
11.6(L) x 8.0(W) 4.3(H) mm

### Components
- Silicone lens
- Ceramic base
- MEMS sensor chip and ASIC

### Specification Table

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power voltage</td>
<td>3.3V ±10%, 5V ±10%</td>
</tr>
<tr>
<td>Current consumption</td>
<td>4.5mA (normal), 0.8mA (standby), 0.2mA (sleep)</td>
</tr>
<tr>
<td>View angle</td>
<td>60 degrees (x,y)</td>
</tr>
<tr>
<td>Absolute temperature accuracy</td>
<td>High gain: 2.5ºC (typ.)</td>
</tr>
<tr>
<td></td>
<td>Low gain: ±3ºC (typ.)</td>
</tr>
<tr>
<td>Noise Equivalent Temperature Difference</td>
<td>0.5ºC @ 10Hz</td>
</tr>
<tr>
<td>Frame rate (selectable)</td>
<td>1 frame/sec or 10 frames/sec</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>0 ~ 80ºC (high gain), -20 ~ 80ºC (low gain)</td>
</tr>
<tr>
<td>Detection temperature range</td>
<td>0 ~ 80ºC (high gain), -20 ~ 100ºC (low gain)</td>
</tr>
<tr>
<td>External interface</td>
<td>I2C 12bit</td>
</tr>
<tr>
<td>Operation mode</td>
<td>Normal, Standby, Sleep (Selectable)</td>
</tr>
</tbody>
</table>
MEMS Technology of Grid EYE

Downsizing and Larger pixel number by Unique MEMS Technology

8×8 Infrared Array Sensor Chip
(Chip Size: 3mm×3mm)
Principle of Grid-EYE

Sensor \Rightarrow Selector \Rightarrow Digital Output
Effective detection distance for human detection

Grid-EYE detects human from about 5m away with using appropriate software

Grid-EYE  Related chart of distance and detection zone from one pixel of sensor

Grid-EYE detects human from about 5m away with using appropriate software
Grid-EYE Evaluation Kit

- Launching Beginning of October
- Includes an on board Panasonic Bluetooth Module
SUMMARY
“GRIDEYE” SUMMARY

Features of IR “Grid Eye” sensor
- 8x8 IR pixels matrix
- Accurate temperature detection
- Digital output
- Small SMD package

Added Value
- Accurate people monitoring
- Energy savings
- Increased comfort
- Safety
- Low price

Applications
- People detection
- People counting
- Air conditioning
- Home appliance
Thank you