HAGISONIC CO., LTD.

Leading Company of Advanced Sensors
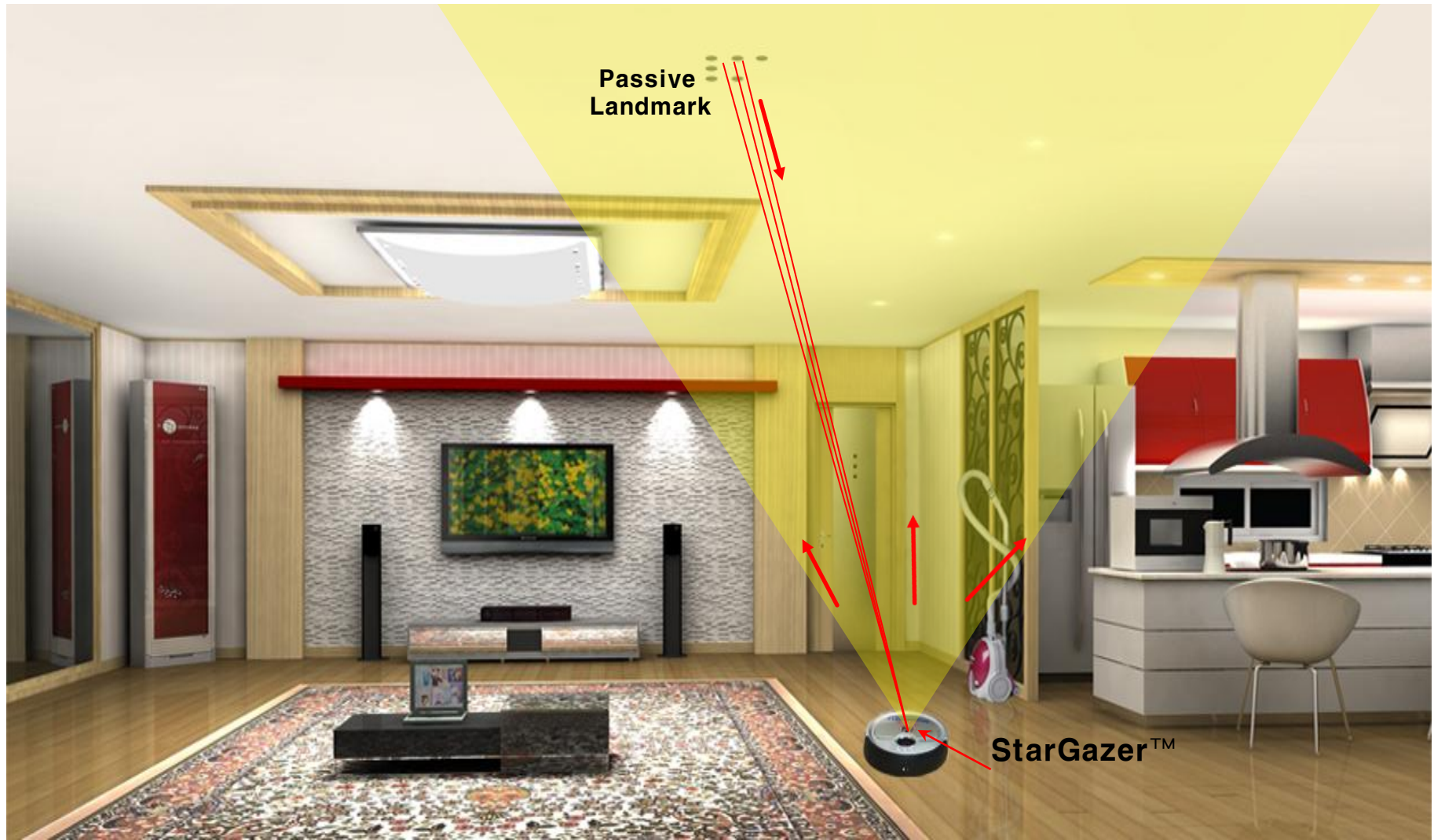
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Localization Technology (StarGazer™)
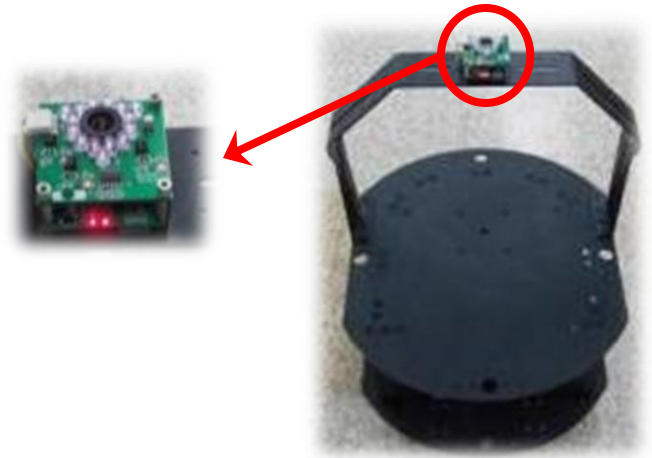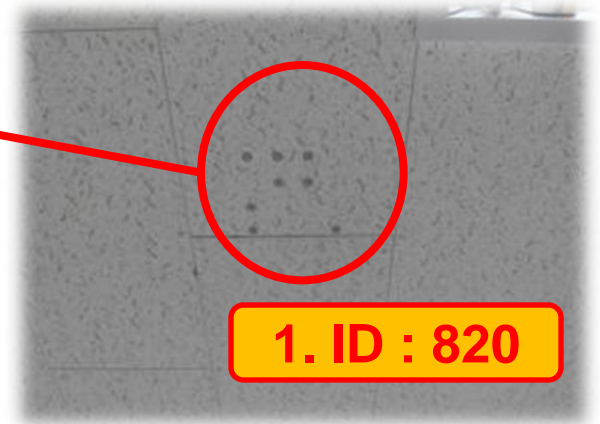
Landmark

StarGazer ™ on Top

StarGazer ™

1) The IR projector in **StarGazer™** shoots off infrared rays at the **Landmark** on the ceiling.

2) And then, the landmark points reflects back the rays to the **StarGazer™** on top of a robot.

3) At the same time, the reflected infrared rays turns into an image by CMOS Sensor Array of **StarGazer™**

4) Through a digital image processing, **StarGazer™** calculates the position and angle of a robot by analyzing the acquired image.

INITIAL SETTING
- ALONE MODE
(1 LANDMARK)

Passive Landmark

StarGazer™

HAGISONIC

1. ID : 820

**ROBOT PLATFORM
- HAGIBOT-R**

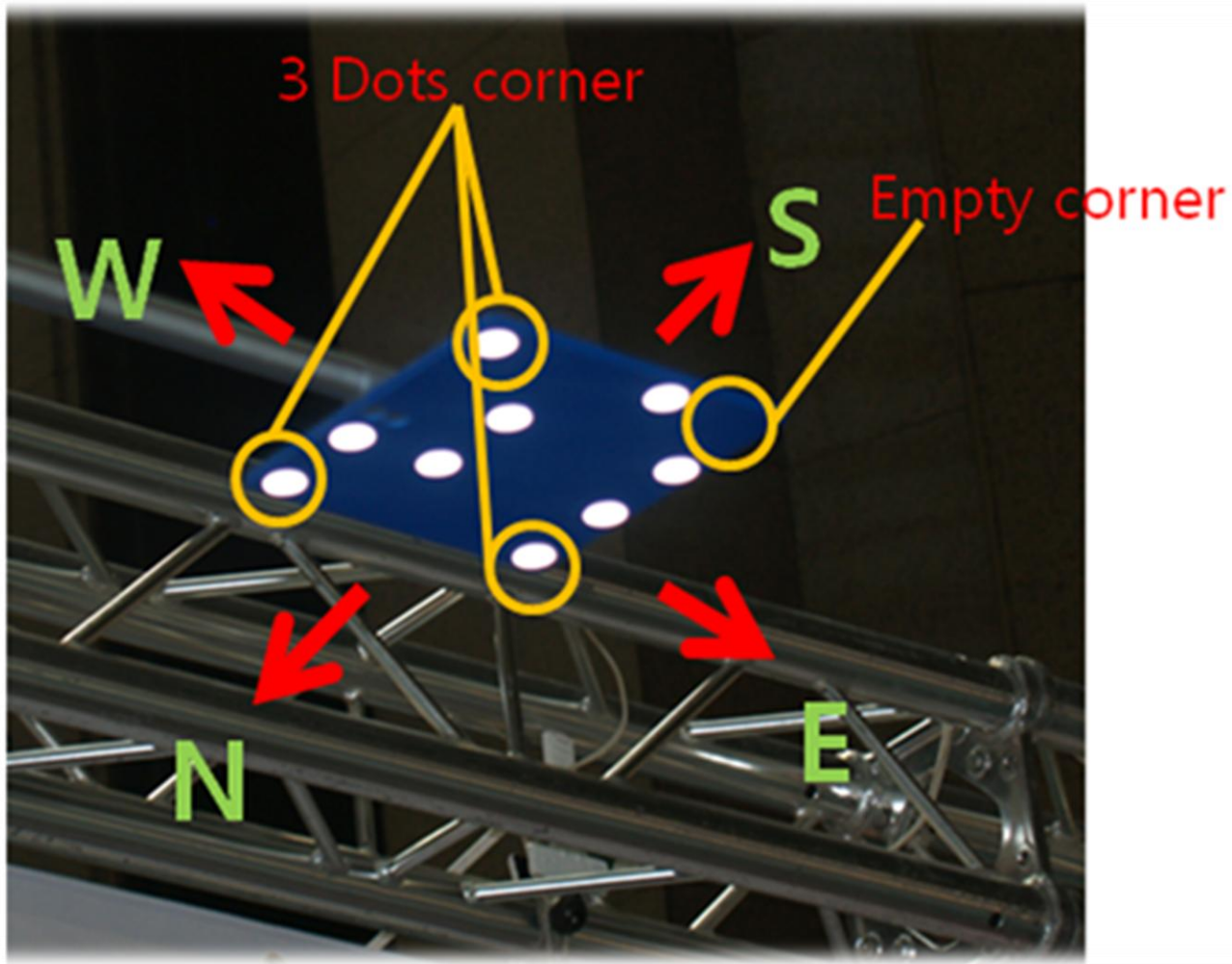- **CEILING HEIGHT : APPOX 1.8 M**

- **ID# : 820**

- **In alone mode, when StarGazer sees other landmark, it will see the another landmark as a center point and coordinate data will be changed to the 2nd landmark.**

HAGISONIC

YOUR PC IS LOCATED IN SOUTH AND LOOKING AT NORTH

TRY TO PUT THE LANDMARKS AS ABOVE
-TO GET THE EXACT HEADING ANGLE DATA

We used Bluetooth to communicate between StarGazer and PC
 - You might have to use the wire serial cable for the first time

StarGazer

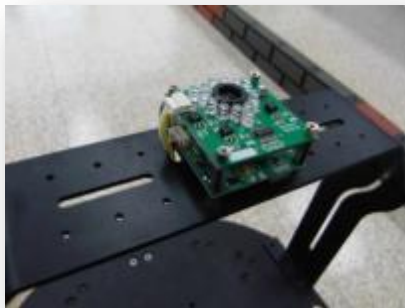**Receiver(Robot)**

Transmitter(PC)

StarGazer

- **Make sure both LEDs are on and Left LED is blinking**
- **Blinking means it recognizes the LANDMARK**
- **If the landmark type is different it might not blink but it still communicates with PC. If this happens please change to different ID type!!!**
  (e.g. HLD1-S→HLD1-L)

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1. **Path : www.hagisonic.com-Products – 1 – 2 – 3**
2. **StarGazerMonitor 1.0904.18 : Firmware 2.0904.16 or later**
3. **StarGazerMonitor v1.0901.07 : Firmware 2.0901.07 or later**
4. **StarGazer Sample Program : Firmware 2.08xx.xx.**

Please set the port and Baudrate for your cable or other communication method (We are using Port (COM5) and Baudrate (115,200) for this test.

When you finish setting the port, the program will start receiving the data

When 'CalcStop' is clicked, disabled buttons in 'StarGazer Setting' are activated.
-This is to prevent data interuption when StarGazer is communicating w/ PC
When 'CalcStart' is clicked, all the buttons in 'StarGazer Setting' are disabled.

◼ Default Data(1/1)

StarGazerMonitor1.0904.16-04

StarGazer Infomation
Firmware Version — Get — [ ]

StarGazer Setting

CalcStop

Num of Landmark	Send	Get	4
Reference ID	Send	Get	2
Landmark Height Fix — Yes	No	Get	No
Landmark Height(mm)	Send	Get	1826
Landmark Type ▼	Send	Get	HLD1L
Mode Setting — Alone	Map	Get	Alone
Serial Port Baudrate ▼	Send	Get	115200

SetEnd

Height Measure — Start
Map-building Process — Start

CalcStart

Sended Data
Send Data [~@BaudRate`]

Received Data
ACK [~!BaudRate`]
Get Data [~$BaudRate|115200`]
Calc Data [~^|820|−93,42|+4,55|−3,20|182,63`]
ID Num [820] Height [182,63] cm
Angle [−93,42] deg, X [+4,55] cm Y [−3,20] cm

Computer Serial Setting
Port COM5 ▼
Baudrate 115,200 ▼

Data Logging
Log File — Log Start — Log End

Clear

Exit

Map Info

• Current Data

1. Click 'CalcStop'

2. Click 'Get' to get the current data

Current data are displayed

StarGazer Setting
 - Num of Landmark (for Map mode)
 - Reference ID(first ID on Map Mode)
 - Landmark Height Fix
   - Yes : use fixed height
       1. Type in the height manually in 'Landmark height(mm)'
       2. Use 'HeightMeasure' button
   - No : StarGazer calculates the height 10 times / sec automatically
 - Landmark Height(mm) : for 'Yes' mode
 - Landmark type : 6 different types
 - Mode Setting : Alone mode(1 ID)
                   Map mode(Multiple ID)
 - Serial Port Baudrate : Change baudrate
- SetEnd : to set the command
        (Always click this button after changing the data)
- Height Measure : Height measure for 'Yes' mode
- Map-building Process(for Multiple ID, Map Mode)
- CalcStart : Restart the process

◼ CHANGE THE CURRENT DATA(1/5)

• **Changing the Current Data**

Always Click 'CalcStop' before any data change!

StarGazerMonitor1.0904.16-04

StarGazer Infomation
Firmware Version — Get

StarGazer Setting
CalcStop

Num of Landmark	Send	Get	4
Reference ID	Send	Get	2
Landmark Height Fix	Yes	No	Get	No
Landmark Height(mm)	Send	Get	1826
Landmark Type	Send	Get	HLD1L
Mode Setting	Alone	Map	Get	Alone
Serial Port Baudrate	Send	Get	115200

SetEnd
Height Measure — Start
Map-building Process — Start
CalcStart

Sended Data
Send Data ~@BaudRate`

Received Data
ACK ~!BaudRate`
Get Data ~$BaudRate|115200`
Calc Data ~^|820|-93,42|+4,55|-3,20|182,63`

ID Num 820   Height 182,63 cm
Angle -93,42 deg, X +4,55 cm Y -3,20 cm

Computer Serial Setting
Port COM5
Baudrate 115,200

Data Logging
Log File   Log Start   Log End
Clear

Exit

1. Input the new data or select it from drop down menu

2. Click 'Send'

3. Always Click 'SetEnd' after clicking 'Send'

- wait until '~!ParameterUpdate' is displayed on ACK

4. Click 'Get' to see the current or changed data

• **Restart Receiving Data**

5. Click 'CalcStart'

Two option for changing data.
1. Change each data by clicking SetEnd every time.
2. Change all the data and press 'SetEnd' at the end

■ CHANGE THE CURRENT DATA(2/5)

• Landmark Type Change

1. Click 'CalcStop'

2. Click drop down menu and select 'Landmark type'

3. Click 'SetEnd'

4. wait until '~!ParameterUpdate' is displayed on ACK

• Landmark Model

HLD1-S(HLD1-1)	1.1M~2.9M 3X3 (31 id Combination)
HLD1-L(HLD2-1)	1.1M~2.9M 4X4 (4,095 id Combination)
HLD2-S(HLD1-2)	2.9M~4.5M 3X3 (31 id Combination)
HLD2-L(HLD2-2)	2.9M~4.5M 4X4 (4,095 id Combination)
HLD3-S(HLD1-3)	4.5~6M 3X3 (31 id Combination)
HLD3-L(HLD2-3)	4.5~6M 4X4 (4,095 id Combination)

StarGazerMonitor1.0904.16-04

StarGazer Information
Firmware Version — Get

StarGazer Setting
CalcStop
Num of Landmark — Send — Get — 4
Reference ID — Send — Get — 2
Landmark Height Fix — Yes — No — Get — No
Landmark Height(mm) 2000 — Send — Get — 2000
Landmark Type — Send — Get — HLD1L
Mode Setting (HLD1S/HLD1L/HLD2S/HLD2L/HLD3S/HLD3L) — Map — Get — Alone
Serial Port Baudrate — Send — Get — 115200
SetEnd
Height Measure — Start
Map-building Process — Start
CalcStart

Sended Data
Send Data ~@MarkHeight`

Received Data
ACK ~!MarkHeight`
Get Data ~$MarkHeight|2000`
Calc Data ~^|820|-93,42|+4,54|-3,20|182,75`
ID Num 820 — Height 182,75 cm
Angle -93,42 deg, X +4,54 cm Y -3,20 cm

Computer Serial Setting
Port COM5 — Baudrate 115,200

Data Logging
Log File — Log Start — Log End

Clear

Exit

◨ CHANGE THE CURRENT DATA(3/5)

• CHANGING BAUDRATE

1. Click 'CalcStop'

2. Click drop down menu and select 'Baudrate'

3. Click 'SetEnd'

4. '~!ParameterUpdate' will not displayed on ACK.
(it will not receive data from StarGazer because even StarGazer sends the data PC's baudrate is different. When you set StarGazer and PC's baudrate it will start receiving Data)

Default : 115,200
- Using 115,200 is recommended.
- If you change the Baudrate, you have to change the PC's Baudrate.
- If you use wireless comm., you also, have to change the wireless device's Baudrate.

◨ CHANGE THE CURRENT DATA(4/5)

• **CHANGING HEIGHT(OPTION1)**

▶ **Landmark Height Fix : No Mode**

1. Click 'CalcStop'

2. Click 'No'

3. Click 'SetEnd'

4. wait until '~!ParameterUpdate' is displayed on ACK

No Mode
-StarGazer will calculate the ceiling
 10 times / sec
- No fixed height

◼ CHANGE THE CURRENT DATA(5/5)

StarGazerMonitor1.0904.16-04

StarGazer Infomation
Firmware Version — Get

StarGazer Setting

CalcStop

Num of Landmark	Send	Get	4
Reference ID	Send	Get	2
Landmark Height Fix	Yes	No	Get	No
Landmark Height(mm) 2000	Send	SetA...	2000
Landmark Type	▼ Send	Get	HLD1L
Mode Setting	Alone	Map	Get	Alone
Serial Port Baudrate	▼ Send	Get	115200

SetEnd

Height Measure — Start
Map-building Process — Start

CalcStart

Sended Data
Send Data | ~@MarkHeight`

Received Data
ACK | ~!MarkHeight
Get Data | ~$MarkHeight| 2000`
Calc Data | ~^|820| −93,42| +4,54| −3,20| 182,75`

ID Num | 820 | Height | 182,75 cm
Angle | −93,42 deg. | X | +4,54 cm | Y | −3,20 cm

Computer Serial Setting
Port COM5 ▼
Baudrate 115,200 ▼

Data Logging
Log File | Log Start | Log End

Clear

Exit

• CHANGING HEIGHT(OPTION2)

▶ **Landmark Height Fix : Yes Mode**
 1. Type in Manually

1. Click 'CalcStop'

2. Click 'Yes'

3. Type 'ceiling height' (numbers only)

4. Click 'SetEnd'

5. wait until '~!ParameterUpdate' is displayed on ACK

 2. Click 'Height Measure' Button

1. Click 'Height Measure'

2. wait until '~!ParameterUpdate' is displayed
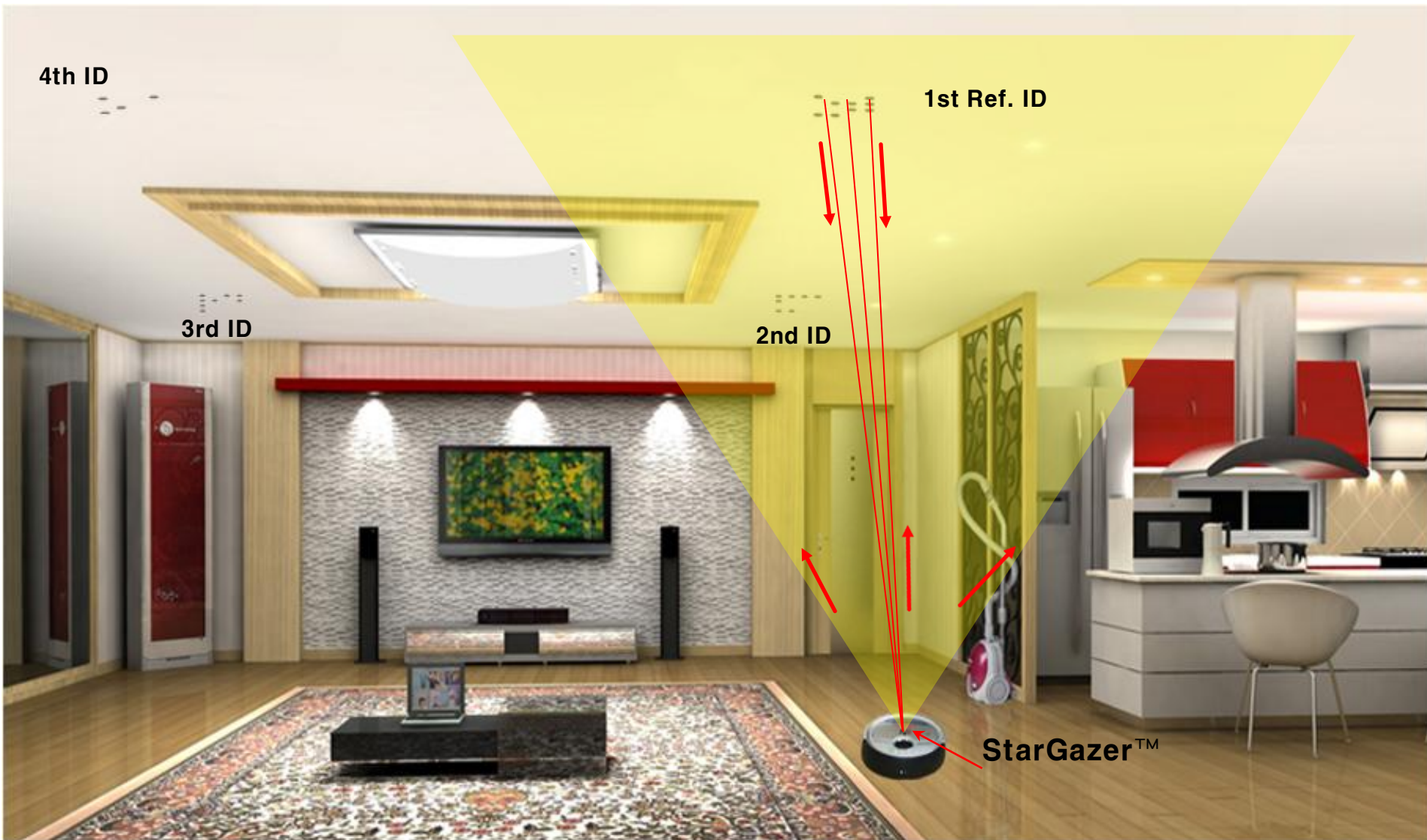
Yes Mode
-fixed Height is used
-'Height Measure' button :
   • Best result will be given if StarGazer is right below the Landmark
   • StarGazer is calculating height(Height may not be correct since it might have moved from landmark)

MAP MODE
(MAP-BUILDING)

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4th ID

1st Ref. ID

3rd ID

2nd ID

StarGazer™

*4 Landmarks(IDs) were used in this test

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4. ID : 834

1. REF.ID : 820

3. ID : 832

Starting Position

2. ID : 822

ROBOT PLATFORM - HAGIBOT-R

Try to place your application right under the first ID. This ID is called Ref. ID(0,0). Other IDs are added to this position. Only 4 IDs(this test) are recognized after map-building.

- **4 LANDMARKS**
- **CEILING HEIGHT : APPOX 1.8 M**
- **REF. ID : 820(FIRST LANDMARK)**

HAGISONIC

STEP 1

• **Number of Landmark**

1. Click 'CalcStop'

2. Type 'Num of Landmark' (4 for this test)

3. Click 'Send'

4. Click 'SetEnd'

5. wait until '~!ParameterUpdate' is displayed on ACK

Num. of Landmark Combination
 - 3x3 : up to 31 ids
 - 4x4 : up to 4095 ids

StarGazer memorize 4 landmarks in a row and only detects the landmarks.

If there are different number of landmarks, StarGazer might not stop map-building mode.

STEP 2

• **Ref. ID number(1st landmark)**

1. Click 'CalcStop'

2. Type 'Ref. ID' number (820 for this test)

3. Click 'Send'

4. Click 'SetEnd'

5. wait until '~!ParameterUpdate' is displayed on ACK

Reference ID is important because it is the (0,0) coordinate. Map-building is the procedure to add other landmark's area to the Reference ID.
(other 3 landmarks(ID) and area(coordinates) are added to the first landmark(Ref. ID 820) for this test)

STEP 3

• Landmark Type Change

1. Click 'CalcStop'

2. Click drop down menu and select 'Landmark type'

3. Click 'SetEnd'

4. wait until '~!ParameterUpdate' is displayed on ACK

• Landmark Model

HLD1-S(HLD1-1)	1.1M~2.9M 3X3 (31 id Combination)
HLD1-L(HLD2-1)	1.1M~2.9M 4X4 (4,095 id Combination)
HLD2-S(HLD1-2)	2.9M~4.5M 3X3 (31 id Combination)
HLD2-L(HLD2-2)	2.9M~4.5M 4X4 (4,095 id Combination)
HLD3-S(HLD1-3)	4.5~6M 3X3 (31 id Combination)
HLD3-L(HLD2-3)	4.5~6M 4X4 (4,095 id Combination)

STEP 4

• **CHANGING HEIGHT(OPTION1)**

▶ **Landmark Height Fix : No Mode**

1. Click 'CalcStop'

2. Click 'No'

3. Click 'SetEnd'

4. wait until '~!ParameterUpdate' is displayed on ACK

No Mode
-StarGazer will calculate the ceiling
 10 times / sec
- No fixed height

STEP 5

StarGazerMonitor1.0904.16-04

StarGazer Infomation
Firmware Version [Get] [   ]

StarGazer Setting

[CalcStop]

Num of Landmark	[ ] Send	Get	4
Reference ID	[ ] Send	Get	2
Landmark Height Fix	[Yes] [No]	Get	No
Landmark Height(mm)	[2000] Send	Get	2000
Landmark Type	[▼] Send	Get	HLD1L
Mode Setting	[Alone] [Map]	Get	Alone
Serial Port Baudrate	[▼] Send	Get	115200

[SetEnd]

Height Measure [Start]
Map-building Process [Start]

[CalcStart]

Sended Data
Send Data [~@MarkHeight`]

Received Data
ACK [~!MarkHeight]
Get Data [~$MarkHeight| 2000`]
Calc Data [~^l820| -93,42| +4,54| -3,20| 182,75`]

ID Num [820]   Height [182,75] cm
Angle [-93,42] deg, X [+4,54] cm Y [-3,20] cm

Computer Serial Setting
Port [COM5 ▼]
Baudrate [115,200 ▼]

Data Logging
[Log File] [Log Start] [Log End]

Map Info

[Clear]

[Exit]

• CHANGING HEIGHT(OPTION2)
▶ **Landmark Height Fix : Yes Mode**
1. Type in Manually

1. Click 'CalcStop'

2. Click 'Yes'

3. Type 'ceiling height' (numbers only)

4. Click 'SetEnd'

5. wait until '~!ParameterUpdate' is displayed on ACK

2. Click 'Height Measure' Button

1. Click 'Height Measure'

5. wait until '~!ParameterUpdate' is displayed

Yes Mode
-fixed Height is used
-**'Height Measure'** button :
  • **Best result will be given if StarGazer is right below the Landmark**
  • **StarGazer is calculating height(Height may not be correct since it might have moved from landmark)**

STEP 6

• Mode Setting

1. Click 'CalcStop'

2. Click 'Map'

4. Click 'SetEnd'

5. wait until '~!ParameterUpdate' is displayed on ACK

Alone Mode : using only 1 Landmark(ID)
- If it sees another landmark, (0,0) will be move to the second landmark.

Map Mode : using multiple landmarks(ID)
- Preset number of landmarks are used
- It only detects the landmarks which were set in this process.(it doesn't read other landmarks after the map mode)

STEP 7 – Map-Building Process(Start)

IMPORTANT
1. Start from Ref.ID.
2. Slowly move to next ID.
3. Always, StarGazer must Stop in 'OFFSET area' for a moment to receive the 2nd ID.
2. After that StarGazer must proceed to 2nd ID area until it doesn't see the 1st ID.
3. This applies to all the landmarks.

Click 'Map-building Process' Button

StarGazerMonitor1.0904.16-04

StarGazer Infomation
Firmware Version — Get

StarGazer Setting
CalcStop

Landmark Height Fix | Yes | No | Get | Yes
Landmark Height(mm) | | Send | Get | 1826
Landmark Type | ▼ | Send | Get | HLD1L
Mode Setting | Alone | Map | Get | Map
Serial Port Baudrate | ▼ | Send | Get | 115200

SetEnd

Height Measure — Start
Map-building Process — Start
CalcStart

Sended Data
Send Data | ~#MapMode|Start`

Received Data
ACK | ~!MapMode|Start`
Get Data | ~$MarkMode|Map`
Calc Data | ~^F820| -89,59| +15,20| -1,44| 182,63`

ID Num | 820 | Height | 182,63 cm
Angle | -89,59 deg, | X | +15,20 cm | Y | -1,44 cm

Computer Serial Setting
Port COM5 ▼
Baudrate 115,200 ▼

Data Logging
Log File | Log Start | Log End

Clear

Exit

Map Info

2nd ID (822)

OFFSET area

Ref. ID (820)

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STEP 7-1 – Map-Building Process(Ref.ID)

1. REF.ID : 820

When your application is right under the Ref. ID and 'Map-building Process Start btn' is clicked Data format changes from'~^I' to '~^F' until map-building is finished. (If Ref.ID and actual landmark ID is different map-building will not start)

StarGazerMonitor1.0904.16-04

Map Info

Serial Port Baudrate [▼] Send Get 115200

SetEnd

Height Measure Start

Map-building Process Start

CalcStart

Sended Data

Send Data ~#MapMode|Start`

Received Data

ACK ~!MapMode|Start`

Get Data ~!MarkMode|Map`

Calc Data ~^F|820|−89,59|+15,20|−1,44|182,63`

ID Num 820 Height 182,63 cm

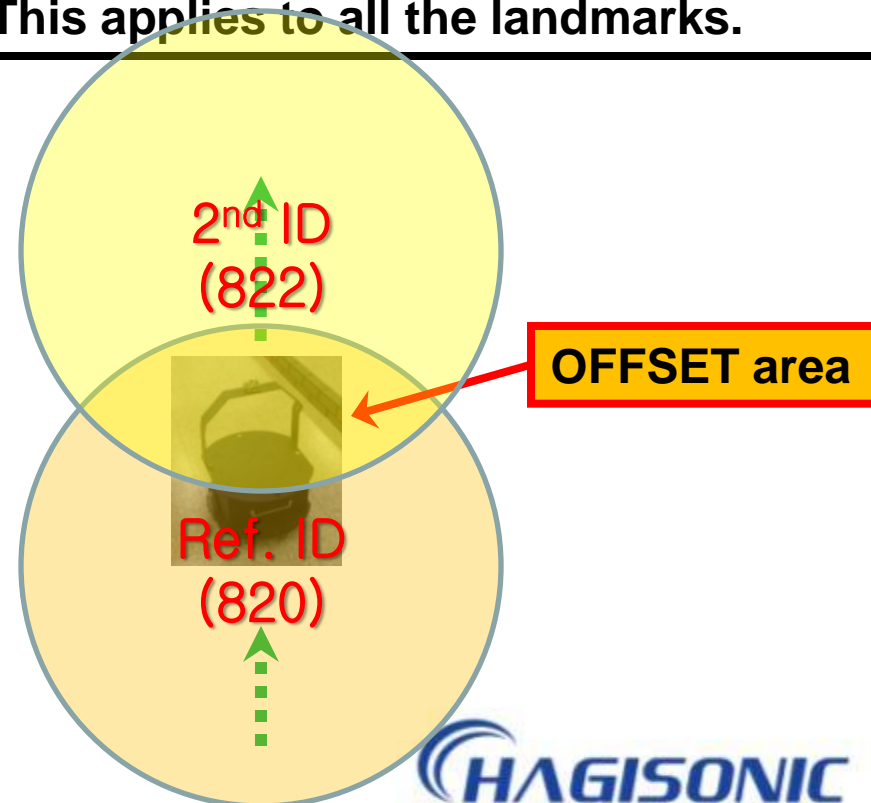Angle −89,59 deg. X +15,20 cm Y −1,44 cm

Computer Serial Setting
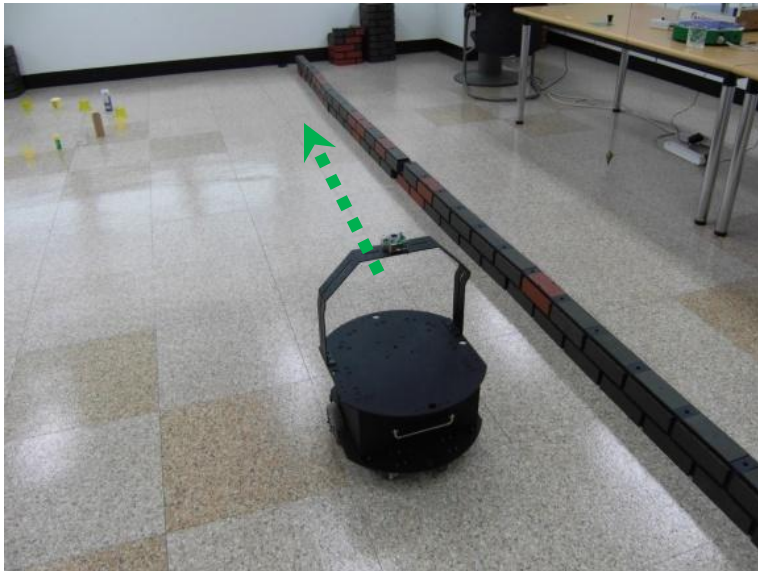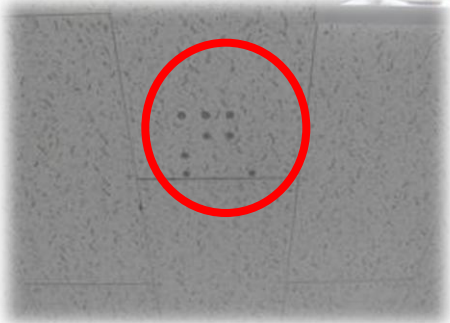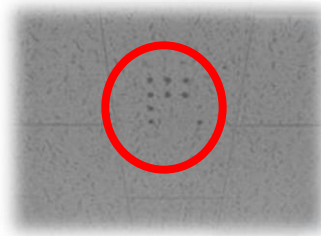
Port COM5 ▼

Baudrate 115,200 ▼

Data Logging

Log File Log Start Log End

Clear

Exit

STEP 7-2 – Map-Building Process(2nd ID)

1. **Slowly move to your 2nd landmark(822 in this test).**
2. **Please stop for a moment in between Ref.ID and 2nd ID(OFFSET area).**
3. **When StarGazer see the 2nd landmark, it will display the landmark data to the Monitoring program.** ①
4. **After ① is recognized, please move forward until ② is recognized and displayed(820→822).**
5. **Proceed to next Step.**

2. ID : 822

StarGazerMonitor1.0904.16-04

StarGazer Infomation
Firmware Version   Get   ①   Map Info 822

StarGazer Setting

CalcStop

Num of Landmark   Send Get   4
Reference ID   Send Get   820
Landmark Height Fix   Yes   No Get   Yes
Landmark Height(mm)   Send Get   1826
Landmark Type   ▼   Send Get   HLD1L
Mode Setting   Alone Map Get   Map
Serial Port Baudrate ▼   Send Get   115200

SetEnd

Height Measure   Start
Map-building Process   Start

CalcStart

Sended Data
Send Data   ~#MapMode|Start`

Received Data
ACK   ~!MapMode|Start`
Get Data   ~$MarkMode|Map`
Calc Data   ~^F822|-80,14|+25,20|+151,70|182,63`
ID ② 822   Height   182,63 cm
Angle   -80,14 deg, X   +25,20 cm Y   +151,70 cm

Computer Serial Setting   Data Logging
Port COM5 ▼   Log File Log Start Log End
Baudrate 115,200 ▼

Clear

Exit

HAGISONIC

STEP 7-3 – Map-Building Process(3rd ID)

1. **Slowly move to your 3rd landmark(832 in this test).**
2. **Please stop for a moment in between 2nd ID and 3rd ID(OFFSET area).**
3. **When StarGazer see the 3rd landmark, it will display the landmark data to the Monitoring program.** ①
4. **After** ① **is recognized, please move forward until** ② **is recognized and displayed(822→832).**
5. **Proceed to next Step.**

3. ID : 832

StarGazerMonitor1.0904.16-04

StarGazer Infomation
Firmware Version Get

Map Info
822
832

StarGazer Setting
CalcStop

Num of Landmark	Send	Get	4
Reference ID	Send	Get	820
Landmark Height Fix	Yes	No	Get	Yes
Landmark Height(mm)	Send	Get	1826
Landmark Type	Send	Get	HLD1L
Mode Setting	Alone	Map	Get	Map
Serial Port Baudrate	Send	Get	115200

SetEnd

Height Measure   Start
Map-building Process   Start
CalcStart

Sended Data
Send Data ~#MapMode|Start`

Received Data
ACK ~!MapMode|Start`
Get Data ~$MarkMode|Map`
Calc Data ~^F832|+103,94|−167,77|+210,89|182,63`

ID | 832   Height | 182,63 cm
Angle | +103,94 deg. X | −167,77 cm Y | +210,89 cm

Computer Serial Setting
Port COM5
Baudrate 115,200

Data Logging
Log File Log Start Log End

Clear

Exit

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STEP 7-3 – Map-Building Process(4th ID)

1. **Slowly move to your 4th landmark(834 in this test).**
2. **Please stop for a moment in between 3rd ID and 4th ID(OFFSET area).**
3. **When StarGazer see the 4rd landmark, it will display the landmark data to the Monitoring program. ①**
4. **After ① is recognized, please move forward until ② is recognized and displayed(822→832).**
5. **Also, it will finish the map-building (Data '~^F' chages to '~^I' in 'Calc Data' and '~!ParameterUpdate' is displayed).**

4. ID : 834

4. ID : 834

1. REF.ID : 820

3. ID : 832

2. ID : 822

- **Now, starting from Ref.ID(820) all the IDs(822,832,834) and location information is stored in StarGazer.**
- **StarGazer will not recognize any other landmarks(IDs) since it stored only 4 IDs.**
- **Landmark order and number of landmarks can be changed.**

HAGISONIC

FOR TECHNICAL SUPPORT,
PLEASE EMAIL US

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