Introduction of Living Safety Monitoring Service for Elderly housing Welfare
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IoT-based Housing Welfare Service
Life safety Care Solution for the Aged weak living alone.

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01 Business Introduction
© IoT-based elderly living welfare monitoring service

The goal of this service is to prevent "solitary death" of elders and support "elderly living welfare". A contactless·senseless·non restraint IoT sensor checks the movement (location and action), breathing of the elders living alone in the house to monitor the health 24/7.

<table>
<thead>
<tr>
<th>Wireless Bio-information Measurement Sensor</th>
<th>○ Able to collect Accurate bio-information check using ultra-wideband ○ Low-power, minimized, and increased resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>AI Technology applied</td>
<td>○ Recognize analysis of the personal pattern and the situation by algorithm based machine learning</td>
</tr>
<tr>
<td>Message Service</td>
<td>○ Send a message to the designated administrator and his/her guardian when symptoms or dangerous situation.</td>
</tr>
</tbody>
</table>

※ Patent Application (date: 2018-11-15)

- Name of Patent: “The care service control system for the elders living along based on ultra-wideband(UWB) radar sensor and AI technology”
- Application No.: 10-2018-0140541
- Applicant Name: I-heart Co., Ltd. / Inventor name: Kim Hyeong-Cheol
1-2. Market background (1/3)

© Increased rate of solitary deaths of one-person households

- The more society network due to increasing of one person household, low birth/aging, family dissolution and so on are weak, The more dying alone is increasing.
- According to the report from the Ministry of Health and Welfare, the rate of unattended death has been rate from 749 in 2012 to **1,232 in 2016**

© The Status and Limit of Emergency Medical System

The status and limit of “Emergency Alarm Service” launched by Ministry of Health and Welfare (MHW)

- Implement the monitoring of emergency situation by installing fire/gas detection sensor in houses of the disabled and elderly people living (U-Care system for elderly people living alone has operated and operated since 2008).
- The devices have been used for over 5 years.
- Since the system cannot deal with different lifestyle nor provide optimized analysis, it is difficult to figure out emergency situations.
1-2. Market background (2/3)

The population ratio of the people over 65 has increased to 13.8% (approx. 7 million) in 2017.

<table>
<thead>
<tr>
<th>Year</th>
<th>Population Rate 65+</th>
<th>65-69</th>
<th>70-79</th>
<th>80+</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>1.25%</td>
<td></td>
<td></td>
<td></td>
<td>1.25%</td>
</tr>
<tr>
<td>2000</td>
<td>3.30%</td>
<td></td>
<td></td>
<td></td>
<td>3.30%</td>
</tr>
<tr>
<td>2010</td>
<td>5.90%</td>
<td></td>
<td></td>
<td></td>
<td>5.90%</td>
</tr>
<tr>
<td>2017</td>
<td>13.8%</td>
<td>4.10%</td>
<td>4.50%</td>
<td>3.20%</td>
<td>13.60%</td>
</tr>
</tbody>
</table>

The increasing trend of elderly people aged more than 80 years among 1.3 million households.

Living alone among elderly people 33.5% (approx 1.3 million households)
© Regional Aged Population Rate in 2017

- Seoul: elderly people among the total population 13.3% (1.3 million) ⇒ expected to reach 2.2 million in 2030
- Gyeonggido: elderly people among the total population 11.1% (1.42 million) ⇒ expected to reach 2.96 million in 2030
1-3. Necessity of Technology Development (1/2)

© Necessity of Care Service based on IoT Technology

- Increased rate of crimes and negligent accidents to the elderly people living alone
  - For last 1 year, property crime reaches 0.2%. Violent crimes and voice phishing approaches 0.1% respectively.
  - Occurred 560,000 crime cases against the elderly people for 4 years

- Increased falling accidents of the elderly people
  - 15.9% of the elderly people have experienced falling accidents for last 1 year.

- More elderly people require care service
  - Only 250,000 people used the welfare service among 1.44 million people.
  - Elderly lifestyle managers afford to visit only once a week or call 2-3 times a week as they have to deal with approximately 30 elderly people per manager.

In consideration these situations, it is necessary to develop and introduce the elderly people care system based on diverse information technology including IoT to efficiently and permanently monitor the elderly people living alone.
Necessity of Technology Development (2/2)

© LH, proceeds with smart home demonstration project at the biggest scale in the country

establish smart home system based on IoT technology for 5,000 households including long-term living rental housing and multi-family housing

· LH revealed the plan that proceeds with smart home platform demonstration project based on wireless IoT technology at the biggest scale in South Korea toward 5,000 households including long-term public rental housing and multi-family housing.

· The project covers the application of wireless IoT devices, the establishment of a smart home cloud server and platform, forecasting based on big data collection/analysis, and other customized services.

· According to the Housing Welfare Roadmap released last year, LH has proceeded with development of IoT-based smart home model for residents of long-term public rental housing.

As elderly people are frequently exposed to different cases of negligent accidents in degraded place, issues related to housing safety have increased.

※ The households with the disabled reach 6.7% and the elderly households approach 25.8% in 2016 (Ministry of Land, Infrastructure, and Transport, 2016)

As the number of elderly people and people with dementia increased, the necessity of accident management system has been highlighted in relation to the housing safety of the elderly people as well. The number of one-person households has increased and the matters related to safety and emotional problems have been highlighted as well.

※ The rate of the people with dementia is expected to reach 612,000 in 2014 and 2.71 million in 2050 (Ministry of Health and Welfare, 2015)
02.1 Introduction of Life Safety Monitoring Service
2-1. Service Introduction

○ “Life safety monitoring” service for elderly housing welfare care

⇒ The goal of this service is to prevent “solitary death” of elders and support “elderly living welfare”
A contactless·senseless·non restraint IoT sensor checks movement(location and action), breathing of the elders living alone in the house to monitor the health 24/7. A manager is able to check the safety issue of the households and cope with problems immediately with alarm and feedback.

- Technology detects the Vital sign, breathing and movement that are contactless·senseless·non restraint of IR-UWB Tadar Sensor
- Infer emergency situations and symptoms by learning and analysis based on pattern recognition algorithm and bio-information storage/encryption
- Integrated monitoring and system controlling Management and statistic calculation for an administrator, manager, and client.
- Practical requirements of the public offices applied. Realize the immediate and efficient action against safety matters and symptoms of elderly people’s daily life.
© The Concept of Service Composition

The Elderly Living Safety Monitoring Service detects safety matters and presence of elderly person living alone through a wireless radar sensor in order to send the collected data to the intelligent central server so that an administrator or a manager is able to monitor the safety 24/7. By providing the interface, the service facilitates the public offices to perform the administrative affairs more efficiently as well as lighten burdens of elderly care management. The service minimizes blind spot of administration to provide a stable and efficient environment for elderly care.
The solution consists of “sensor detection”, “intelligent central server” and “control & feedback”.

⇒ **Sensor Detection:** Detects location (distance), action (movement), and presence using IR-UWB Radar and send the collected data to the central server by dedicated modem.

⇒ **Intelligent Central Server:** Collect and store the data and treat/categorize the information by analysis and learning based on pattern analysis and Context Awareness Algorithm.

⇒ **Control & Feedback:** Monitor diverse kinds of data status and receive message feedbacks through the integrated control system for administrators.
## 2-3. Application

© Expansion and application of the service for elderly housing welfare

The purpose of this service is to monitor serious risk factors in the elderly life and detect emergency situation or symptoms to cope with them immediately. By distribution of this system, we expect that this service helps to improve the elderly care as well as the housing welfare of the elderly people.

### Geriatric Diseases

*Cardiovascular diseases may occur by sleep apnoea.*

Repetitive sleep hypoxia and an arousal reaction caused by sleep apnoea promote activity of the sympathetic nervous system and cause diverse cardiovascular diseases including a systemic high blood pressure and stroke. These diseases require immediate and active countermeasure if a patient has sleep apnoea.

<table>
<thead>
<tr>
<th>Sleep Quality Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>The device monitors sleep time, pattern, frequency of movement, and sleep apnoea by using bio sensor (UWB) installed in the bedroom.</td>
</tr>
</tbody>
</table>

### Falling Accidents of the Elderly People

*21% of the elderly people experience a fall accident.*

47.5% of the elderly people who experienced a fall accident reported that they have the aftereffects. The medical cases of elderly fracture by a fall accident has increased. (Health expenditure doubled)

<table>
<thead>
<tr>
<th>Fall Accident Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use a bio sensor (UWB) for danger area (ex: bathroom) to monitor any risk situation that may cause dangerous accident such as a fall.</td>
</tr>
</tbody>
</table>

### Crimes against the Elderly People

*About 560,000 crime cases occurred against the elderly people for last 4 years*

The reports revealed that the crime cases against elderly people over 60 years have reached 562,182 cases since 2013.

<table>
<thead>
<tr>
<th>Criminal Activity Monitoring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitors the client’s location and housebreaking by checking movement and location using bio sensor dedicated for residential space.</td>
</tr>
</tbody>
</table>
2-4. characteristics of service

- **Contactless & senseless sensors to eliminate any blind spot of welfare**
  - Remove blind spots of administration by permanent monitoring through many high-quality sensors and control system
  - A wireless (IR-UWB) radar sensor monitors a client without privacy infringement and resistance

- **AI (Artificial Intelligence) Technology Applied**
  - Inference Algorithm: conduct integrated monitoring and customized analysis/learning by personal pattern analysis and context awareness algorithm

- **Make the rate of solitary deaths ZERO**
  - Install the devices in the elderly households to detect/analyze safety issues including location, movement, and breath in order to detect symptoms in advance and send message to the administrator for immediate countermeasure.
03 I Product & Technology Introduction
## Bio-information Measurement Sensor (1/5)

<table>
<thead>
<tr>
<th>Competency</th>
<th>Movement (distance), breathing, and heart rate (PPG) detection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>7.2-10.2GHz</td>
</tr>
<tr>
<td>Coverage Wide</td>
<td>10m 70˚ Wide</td>
</tr>
<tr>
<td>Warm Up Period</td>
<td>1 approx. 1min</td>
</tr>
<tr>
<td>Power Supply</td>
<td>5~12VDC</td>
</tr>
<tr>
<td>Current Consumption</td>
<td>100mA (Max) at 12VDC (current consumption)</td>
</tr>
<tr>
<td>Output Power</td>
<td>≤-41.3dBm</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 140g</td>
</tr>
<tr>
<td>Antenna Type</td>
<td>Patch Type</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>-25˚C ~ +80˚C</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>95% max</td>
</tr>
<tr>
<td>Mounting Height</td>
<td>2~3m</td>
</tr>
<tr>
<td>LED Alarm Indicator</td>
<td>Red On if detected</td>
</tr>
<tr>
<td>LED Alarm Period</td>
<td>Approx. 0.5 sec</td>
</tr>
<tr>
<td>Interface</td>
<td>Option (Wi-Fi, BLE, LTE, etc.)</td>
</tr>
<tr>
<td>Detection Technology</td>
<td>Impulse Radio UWB (The X4 UWB radar SoC from NOBELDA)</td>
</tr>
</tbody>
</table>
A UWB radar detects presence, housebreaking and measures breathing and Heart rate. It detects minute movement and bio-information passing through obstacles in the way of not touching bodies.
© Smart radar sensor for smart home

1. Presence Detection

(1) Application
· It detects the presence of an elderly person living alone or a sign of a fall accident.
· It detects the current location of the client to support the lighting interface. It also enables administrators to monitor the household so that he/she copes with any emergency situation immediately.

(2) Functions and Features
· It monitors bio-information of the client when he/she is in a stable status such as taking a rest, watching TV, or reading a book.

(3) Detection Distance
· It detects breathing within 5 meters from the sensor.
· It detects movement of an upper body within 8 meters from the sensor.
· Detection function is available within 10 meters from the sensor.
2. Breathing and Heart Rate Detection

(1) Application
- It measures breathing to detect and prevent suddenly occurred emergency situation or sleep apnoea.
- By repetitive measurement, the sensor monitors symptoms of an irregular pulse or sleep apnoea during motionless sleeping.

(2) Functions and Features
- As it does not touch any part of the body to measure breathing and heart rate, a client does not feel inconvenience.

(3) Detection Distance
- The sensor detects heart rate and sleeping hours within 1.5 meters.
- The sensor detects sleep apnoea within 3 meters.
3. Housebreaking Detection

(1) Application
· It supports unmanned home security by detection of housebreaking.

(2) Functions and Features
· The sensor detects windows, porch, and door to monitor movement going in and out of the house.
· The sensor detects housebreaker’s location and movement passing wall or glass.

(3) Detection Distance
· It detects human activity within 10 meters of the sensor’s visible range.
· The sensor skips detection error caused by curtain, branches, plants, or pets.
O Smart Plug Type LTE AP for IoT

⇒ Smart plug type AP dedicated for monitoring service for elderly households. It collects different types of data such as TV energy consumption.
⇒ LTE module-based AP facilitates the sensors to send much bio-data to the central server in real-time.
⇒ Easy to install as a plug type devices.
⇒ Able to collect Wifi data from many sensors installed in the house
3-3. Context Awareness Algorithm

- Recognition/Inference and learning algorithm by pattern analysis

⇒ The system draws a meaningful conclusion by recognition and inference of personal lifestyle and activity pattern by collecting bio-information of the elderly person. By learning the repetitive status, the system detects possible emergency situations and symptoms to propose the best countermeasure.
04 | Control Solution Introduction
4-1. Integrated Dashboard

General Status (summary of status)

- Integrated control of living safety status toward entire households
- Provide the presence status of entire households at that date
- Provide an average index of the households in [safe] level of daily life.
- Provide an average index of the households in [normal] level of daily life.
- Provide an average index of the households in [warning] level of daily life.
- Provide an average index of the households in [dangerous] level of daily life.
- Support message and alarm history check function
  Categorize new and checked messages and alarms
4-2. Household Control

Registration of Households (Register, edit, and delete)

- group registration/setting functions to manage households in different groups
- Check a list of registered households and search specific households by search by conditions
- household registration and edit (individual or group)
- Provide general information of the households as well as information of group, equipment settings, and composition.
**4-3. Real-Time Check**

- Check the data status of the sensors in real-time
- Check the categorized data in a graph
- Indoor sensors provide presence information as well
- Check the current status of the sensors. A restart of the sensors available

---

**Real-time data on measurement**

- Check the data status of the sensors in real-time
- Check the categorized data in a graph
- Indoor sensors provide presence information as well
- Check the current status of the sensors. A restart of the sensors available
4-4. Data Check

Accumulated Generation Data (Search by Period / Section)

○ Check general information such as equipment, group, status, and a list of entire households
○ Search by specific section or period
○ Search summary of an average index of each section (Measurement time, time unmeasured, the number of alarms, equipment stop, frequency of safe/normal/warning/dangerous level occurred)
○ Provide data graphs representing the status of activity, breathing, heart rate, and etc.
○ Provide row data list categorized by different event occurred.
Company Introduction
### 5-1. I-Heart Introduction

<table>
<thead>
<tr>
<th>Company Name</th>
<th>I-Heart Co., Ltd.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEO</td>
<td>Kim Hyeong-Cheol</td>
</tr>
<tr>
<td>Main Business</td>
<td>IoT service, message service, IDC service, Public service</td>
</tr>
<tr>
<td>Employees</td>
<td>34</td>
</tr>
<tr>
<td>The date of incorporation</td>
<td>June 20, 2000</td>
</tr>
</tbody>
</table>
| Address            | Headquarters : Unit 707, 286, Beotkkot-ro, Geumcheon-gu, Seoul, Republic of Korea  
Branch : 2F, 36, Jangmi-ro, Bundang-gu, Seongnam-si, Gyeonggi-do, Republic of Korea |
| Webpage            | www.i-heart.kr  
www.n-forum.com (for message service)  
iot.i-heart.kr (for IoT service) |
5-2. Organization

- CEO
  - R&D Center
  - Board of Directors
  - Business Management Dept.
    - Business Plan Team
    - Infra Team
    - Sales Team
  - Business Dept.
    - Business Plan Team
    - Technical Team
    - Development Team
  - CISO (technical Advice)
5-3. Services (1/3)

◎ IoT Service

**Biometry**
- Provide the effective measuring/monitoring without invasion of life by measuring a client body by senseless·nonrestraint and wireless sensors based on IR UWB Radar.

**Control Service**
- The integrated control system for elderly living safety care service based on I-Heart’s infra facilitates easy and efficient monitoring management.

**IoT Infra**
- Provide stable infra through support of equipment and resource such as server system, SMS message solution, and network including IoT-based LTE, LoRa modulo, and AP.

For guardians, managers, and regional centers SMS message alarm of unusual situations

Related Institutions Emergency Alarm
© Message Service

- **N_FORUM (Website)**: This mobile message service provider supports the easy and convenient function to send text message to many objectives.
- **NPro, Alarm Talk (DB Interlocking Module)**: The service provided by interlocking with database applied to business application.
- **BMS, i-Gov (Customized Service)**: establishes SMS/MMS sending service as a customer requires based on diverse solutions of I-Heart.

![Diagram of Message Service]

**I-Heart**

**WEB SERVICE**

**Mobile communication DB interlocking module**

**Recipient**

**DB Interlocking module**

**Website**

**Customized Services**
5-3. Services (3/3)

IDC Service

I-Heart IDC

IDC Service

Optional Services

IDC Infra

Service Consulting

Customized Services provided

[I-Heart IDC]

<table>
<thead>
<tr>
<th>IDC Service</th>
<th>I-Heart has run IDC service based on the nation’s biggest network composition provides server hosting and co-location services.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional Services</td>
<td>· The optional services provided for safe and convenient e-Business operations of the clients who have used I-Heart hosting and co-location service.</td>
</tr>
<tr>
<td>IDC Infra</td>
<td>· provide stable infrastructures through IDC dedicated indoor storage, power source equipment, and constant temperature/humidity equipment</td>
</tr>
</tbody>
</table>
5-4. History (1/3)

2017~2018

03. Integrated Administration MMS System Establishment for Cheolwon-gun office (MMS)
   Integrated Administration MMS System Establishment for Eumseong-gun office (MMS)
04. Integrated Alarm System Upgrade for Siheung City office (MMS)
05. Integrated Alarm System Upgrade for Gwangju City office (MMS)
   Integrated Administration MMS System Establishment for Cheonan City office (MMS)
06. Integrated Administration MMS System Establishment for Hongcheon-gun office (MMS)
07. Integrated Alarm System Establishment for Hwacheon-gun office (MMS)
11. Integrated Alarm System Establishment for Gangseo-gu office (MMS)
12. ISMS (Information Security Management System) Certificate

2016

05. Messaging system interlocking for 15 Real Estate Trading Systems including Gimpo City office (SMS)
06. MMS System establishment for Bucheon Facilities Management Corporation (MMS)

2015

03. Integrated Administration MMS System Establishment for Geumcheon-gu office (MMS)
04. Integrated Alarm System Upgrade for Gimpo City office (MMS)
05. Integrated Alarm System Upgrade for Bucheon City office (MMS)
06. The Korea Forest Service’s Forest Fire Forecast & Warning Multi System upgrade (MMS)

2014

03. Integrated Administration MMS System Upgrade for Gapyeong-gun office (MMS)
07. Integrated Alarm System Upgrade for Hanam City office (MMS)
11. Integrated Alarm System Establishment for Incheon Seo-gu office (MMS)

2013

02. Integrated Messaging System Elevation Project for Hanam City office (MMS)
03. Integrated Administration MMS System Establishment for Gyeongju City office (MMS)
05. Integrated Alarm System Establishment for Yeongdong-gun office (MMS)
06. Integrated Alarm System Establishment for Gongju City office (MMS)
07. Integrated Alarm System Establishment for Yangpyeong-gun office (MMS)
08. Selected as a joint cooperator for M-Gov project launched by Ministry of Information and Communication
11. Integrated Alarm System Establishment for Hoengseong-gun office (MMS)

2012

11. Improvement of personal information encryption for Yangsan City office
12. Improvement of personal information encryption for Goseong-gun office
<table>
<thead>
<tr>
<th>Year</th>
<th>Projects</th>
</tr>
</thead>
</table>
| 2011 | 02. Participated in SK Networks MMS Gateway System elevation project  
04. Integrated Administrative Information Alarm System Establishment for Yeongyang-gun office (MMS) |
| 2010 | 02. Integrated Alarm System Establishment for Jincheon-gun office (MMS)  
03. Integrated Administration MMS System Establishment for Cheongsong-gun office (MMS)  
05. Integrated Alarm System Establishment for Jeungpyeong-gun office (MMS) |
| 2009 | 01. Integrated Administrative Process Alarm System Establishment for Gwanak-gu office (MMS)  
02. GS Certificate acquisition (TTA technical certificate)  
03. Integrated Administrative Multi System Establishment for Gangseo-gu office (MMS)  
04. Integrated Administrative Process Alarm Message System Establishment for Dongjak-gu office (MMS)  
05. Integrated Administrative Process Alarm Message System Establishment for Jinhae City office (MMS)  
06. The Korea Forest Service’s Forest Fire Forecast & Warning Multi Message System upgrade project for Paju City office (MMS)  
09. Integrated Administrative Process MMS Alarm System Establishment for Andong City office (MMS)  
12. Participated in LG Dacom MMS Gateway System Establishment Project |
| 2008 | 01. Seal Authentication Message System Establishment for Seongdong-gu Office, Seoul  
02. Integrated Administrative Message System Establishment for Daejeon Seo-gu Office  
04. Integrated Administrative Message System Establishment for Geumcheon-gu Office, Seoul  
05. Administrative Affairs Process Alarm Messaging System Establishment for Gangseo-gu Office, Seoul  
07. Administrative Affairs Process Alarm Messaging System Establishment for Ganghwa-gun Office  
09. SMS Integrated System Establishment for Gapyeong-gun office  
12. Participated in LG Dacom MMS Gateway System Establishment Project |

- **History (2/3)**
2007

01. Seal Authentication Message System Establishment for Daejeon Seo-gu Office

05. SK Networks MMS Gateway System Management Service

07. Selected as a joint cooperator for M-Gov project launched by Ministry of Information and Communication

08. Seal Authentication Message System Establishment for Daejeon Jung-gu Office

09. Seal Authentication Message System Establishment for Siheung City Office

Integrated Administrative Message System Establishment for Gwangju City office, Gyeonggi Province

10. Administrative Affairs Process Alarm Messaging System Establishment for Seodaemun-gu Office, Seoul

12. Administrative Process Alarm SMS Automatic Sending System interlocked with Saeol Administrative System (Gimpo City office)

2000~2005

04. 10. Selected as National Community Service Center's message service partner

12. Targeting message service establishment for Korea National Open University

05. 02. The Nation’s First Civil Affair Administration System’s Seal Authentication Message System Establishment (Paju City office)

07. SMS System Establishment for NICE

09. Integrated Medical Information SMS System Establishment for Hallym University Medical Center

2006

02. Integrated Administrative Message System Establishment for Hwaseong City Office

08. Integrated Administrative Message System Establishment for Hanam City Office

10. Integrated Administrative Message System Establishment for Goseong City Office

11. Integrated Administrative Message System Establishment for Incheon Nam-gu office

12. Participated in SK Networks MMS Gateway System Establishment Project
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It is providing services to 35 public offices.
THANK YOU