CARROT SMART
BUILDING SOLUTIONS

For developers of new buildings

Carrot Home Solutions Limited

14/F, Block B, Vita Tower
29 Wong Chuk Hang Road

Phone 852-9098-5228
Email manlam@carrot-home.com

Smart Buildings through robotics, AI and IoT

Autonomous technologies, AI, and internet of things

Our corporate mission is to improve the quality of life through Information and Communication Technologies. We endeavor to make use of innovations and technologies to improve people's quality of living as well as delivering sustainability, efficiency and safety; hence our continuing and extensive investment into the research and development of autonomous systems and internet-of-things applications.

Making products people-centric is our central mission. Going beyond connecting people, we strive to automate the mundane to **free up human spirits** for tasks that truly require the **human attention**, **interaction** and **creativity**.

In this paper, we will present **twelve** of the latest Smart Building Solutions from Carrot that aim to achieve the above mission:

- Smart Display System (SDS)
- Home Energy Consumption Information System (HECIS)
- Water Consumption Information System (WCIS)
- Waste Management Information System (WMIS)
- Home Health and Wellness Information System (HHWIS)
- Building Management System (BMS)
- Integrated Control System
- Autonomous Caretaker Robot
- Smart Visitor Panel (SVP)
- Smart Visitor Registration System
- Smart Clubhouse Management System
- Smart Key Mobile App (S-Key)

Smart Display System (SDS)

- **Hardware platform independent** Graphical User Interface (GUI) for **HECIS, WMIS, HHWIS, WCIS, and BMS**
- **Customizable** using **scripting language** with little efforts to adopt dynamic graphics to different screen resolution and media
- Apps for **IOS** and **Android** mobile platforms
- Web-kit Applications for other computing platforms
- Dynamic graphic and charting capability customized using scripting language for **Smart Displays**
- **Real-time, daily, monthly and yearly** information **dashboard on Smart Displays**, such as iPad, smart mirror and video door-phone, etc.
- **Setting alert levels** when preset information level is exceeded
- Automatic calculation of critical parameters such as **carbon footprint, energy billings, domestic waste data**, etc, and present the results graphically

- Display and integration of other building systems such as **Video Door Phones**, **Lift Control**, **CCTV Cameras**, etc.
- Database connectors to **HECIS, WMIS, HHWIS, WCIS, and BMS**

Smart Mirror can be used as a Smart Display anywhere within the Smart Building, common areas or inside the flat units.

The main objective of the Smart Display System is to provide a hardware independent GUI for the various display systems found in a Smart Building. The Smart Display System shall provide built-in graphic rendering libraries and database connections to data tables stored at various locations (such as HECIS, WMIS, HHWIS, WCIS, and BMS) throughout the building according to the data segregation policy of the building.

Another popular implementation is to integrate the Smart Display System (SDS) with a Video Door Phone inside the flat unit.

The complete SDS includes presentation graphical applications for the Smart Displays in in-Home displays (wall-mounted iPad, Smart Mirror or Android

based Video Door Phone), Lift Displays, Main Entrance Hall Displays, and Clubhouse Displays, including all necessary power supplies and network connectivity.

Since the SDS app can be run on iOS device, the developer can choose to pair SDS on iPad with a luxurious wall mount charger in a high-end offering.

Home Energy Consumption Information System (HECIS)

SDS front page features icons for HECIS for energy information.

- Interfaces with meters for power, gas and water (optional) to collect **real-time** consumption data
- Dynamic graphic capability customized using scripting language for **Smart Displays**
- **Real-time, daily, monthly and yearly** energy information **dashboard on Smart Displays**, such as iPad, smart mirror and video door-phone, etc.
- Display consumption in monetary terms at a glance
- Setting alert levels when preset consumption level is exceeded
- Automatic calculation of carbon footprint and present the result graphically
- Comparison with baseline and other households in the community
- Offer advice on energy and water conservation, based on machine learning of consumption real-time data and history

The GPIO2, our embedded platform services and the Cloud / on-premise Server together constitute the basis of our IoT solution. The GPIO2 is

equipped with numerous digital input and output ports for connection of external commercial or industrial grade sensors for data ingestion into the IoT solution. It can also act as gateway for receiving data from other IoT clients using various communication protocols for smart meters (such as Modbus, etc.). The data can be consolidated in its local memory for edge computing and data segregation, or optionally synchronized with the Cloud / on-premise server for data analytic solutions as necessary.

This Power Consumption function shows the current month's total power consumption and its corresponding carbon emission value. You can display the data for each of the last 12 months by selecting from the drop-down box. You can also set the alert level for over-consumption by selecting the Tool Icon.

This Gas Consumption function shows the current month's total gas consumption and its corresponding carbon emission value. You can display the data for each of the last 12 months by selecting from the drop-down box. You can also set the alert level for over-consumption by selecting the Tool Icon.

GPIO2 provides ample local storage and edge computing capability for temporary storage of localized data subsets and as non-volatile memory for execution of the local control and automation strategies directly on GPIO2. This edge computing capability is essential when time critical response time and standalone operation (when the Cloud or internet uplink is temporarily not available).

The data collected on GPIO2 can be optionally synchronized to the dedicated Cloud via the embedded platform services which also provide library

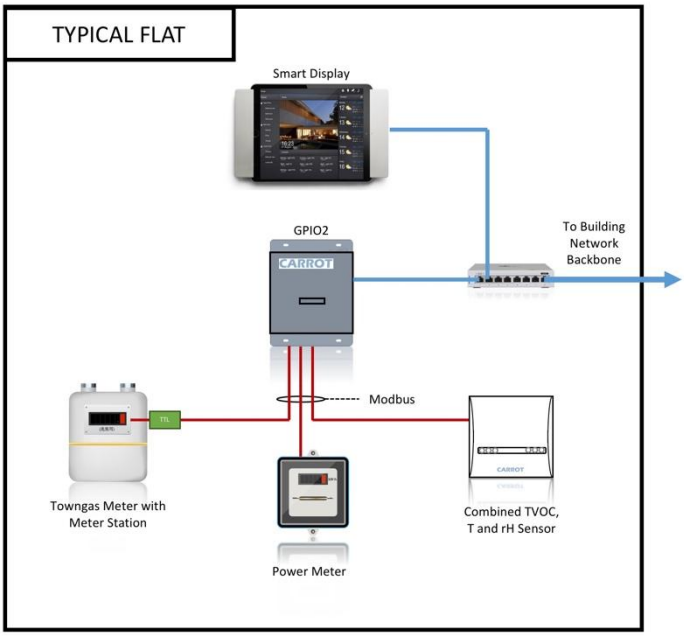
functions, remote management, file system, network services, time service, and backup functions. Project specific backend for data processing and analytics, together with presentation layer UI, can be developed using scripting computer language on a project-by-project basis.

The complete end-to-end HECIS comes with power supplies and the network connectivity to the building backbone. The system includes smart power meters and TTL interface for Meter Station and Gas Meter provided by Hong Kong and China Gas Company Limited (HKCG).

Internet of Things (IoT) Interconnections

All of our solutions are designed from the ground up using this IoT architecture. Our IoT solution consists of three layers of technologies — the cloud backend (or a local backend running on an on-premise server), embedded platform services, and edge computing devices, customized fully to offer the end-to-end development of your business specific solutions.

IoT solutions require secure, bidirectional communication between numerous physical devices, and a solution back end. For example, a solution might use automated, predictive analytics to uncover insights from your device-to-cloud event stream.



Equipment configuration for a typical residential flat for HECIS and HHWIS.

The following diagram shows the key elements of a typical IoT solution architecture. The diagram is agnostic of the specific implementation details such as the cloud services used, devices deployed, and operating systems the solution is running on. In this architecture, IoT devices collect data that they send to a cloud gateway. The cloud gateway makes the data available for processing by other back-end services. These back-end services can deliver data to:

- Other line-of-business applications (such as hotel room control, facility monitoring for property manager, or smart home/building applications, etc.)
- Other predictive analytics using machine learning (Home Energy Consumption Information System, etc.)
- Human operators through a dashboard App or other presentation device or software (such as Home Health and Wellness Information System, or Waste Management Information System, etc.)

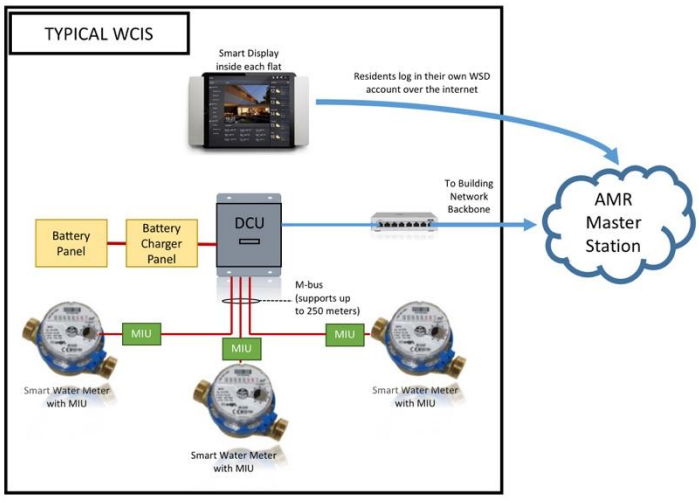
Water Consumption Information System (WCIS)

As part of Carrot's Smart Building Solution, the WCIS is a standalone Automatic Meter Reading Outstation for the collection of water consumption data from smart water meters provided by the Water Supplies Department (WSD).

The WCIS is comprised of one or more AMR Outstations connected together via a high-speed, local area network backbone. Each AMR Outstations, supporting up to 250 smart water meters, is completed with power supplies, including battery chargers and backup battery units for uninterrupted operation during main power outages. Each of the smart water meters is equipped with a meter interfacing unit (both provided by WSD), which is capable of counting and storing the consumption data from the meter for retrieval by the DCU in the AMR Outstation at preset interval.

The entire AMR Outstation assembly is managed by a reliable programmable logic controller that handles the sending of alarm status for the outstation and provide communication self-healing function.

All metering data collected by the WCIS is uploaded to WSD's Master Station in the Cloud through the internet securely over broadband or 3G wireless uplinks. Finally, the residents in the Smart Building will be able to access their private water consumption data through logging in to their WSD account directly.

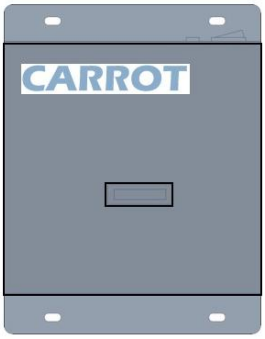


Equipment configuration for a typical WCIS installation in common areas of the new development.

The WCIS shall provide the **efficient**, **accurate** and **reliable** automatic meter reading capability so as to fulfill the following Smart Building and Smart City objectives:

1. Reduction of human labor and errors in the meter reading process
2. Timely information for analysis to alleviate abnormality in water consumption (to detect water leakage within customer premise)
3. Data analysis for service planning and management
4. Timely and frequent update of water consumption data for enhanced customer service
5. Timely consumption data promoting water conservation and awareness

About the GPIO2 Controller



Parameter	Specification
Model No.	CIU-GPIO2
Operating Power	12VDC 800mA
Dimension	160mm (W) x 200mm (H) x 40mm (D)
No. of Digital Inputs	40
No. of Digital Outputs	12
IP Address DIP SW	1
RS-485/Modbus Ports	4
10/100 Ethernet	1
USB 2.0 Ports	2
Power Switch	1
Watch Dog	Y

Waste Management Information System (WMIS)

- Smart garbage bin integrated with sensors and communication interface
- Smart bin ultrasonic **fill-level sensors** indicating refuse fill levels
- Smart bin with **automatic open actuator** using Infrared and motion detection to improve **hygiene**
- Built-in **electronic weight system** to report weight of contents for general refuse and for each of the recycling compartments
- Refuse recycle report to summarize % of household being recycled for each floor and each building
- **Dynamic graphic** capability customized using scripting language for **Smart Displays**
- **Real-time, daily, monthly and yearly** information **dashboard on Smart Displays**, such as iPad, smart mirror and video door-phone, etc.
- Efficiency enhancing application for optimizing the **garbage collection schedule** based on inputs from fill-level sensors

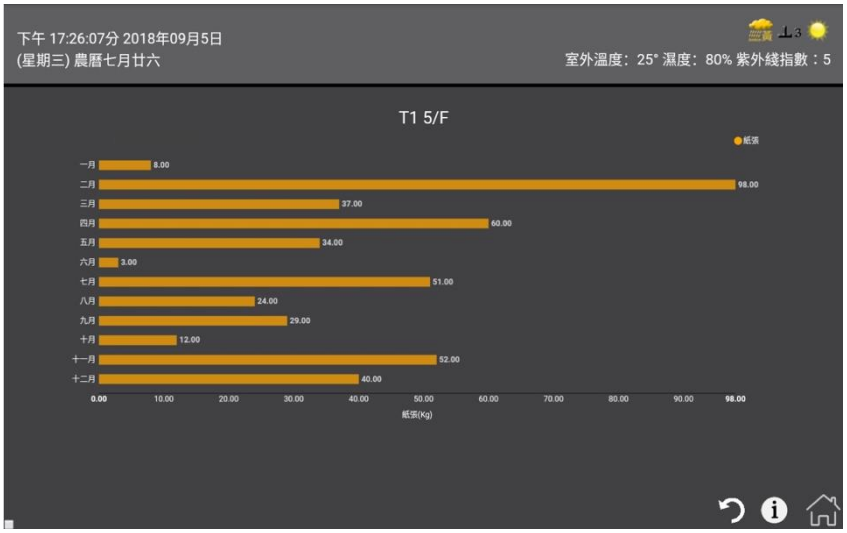
This Garbage Collection Information allows you to view current monthly totals for the various types of waste collected/recycled from this floor. By selecting each of the waste type (General, Paper, Paper Box, Glass, Plastic and Aluminum), you can view the month-by-month collection history the type selected.

A GPIO2 controller is equipped and acts as a gateway for receiving data from all the Custom-made, built-to-order waste collection bins, or Smart Bins,

using IP communication protocols. The data can be consolidated in GPIO2's local memory for edge computing and data segregation, or optionally synchronized with the Cloud / on-premise server for data analytic solutions as necessary.

GPIO2 provides ample local storage and edge computing capability for temporary storage of localized data subsets and as non-volatile memory for execution of the local control and automation strategies directly on GPIO2. This edge computing capability is essential when time critical response time and standalone operation (when the Cloud or internet uplink is temporarily not available).

The data collected on GPIO2 is synchronized to the dedicated Cloud / on-premise server via the embedded platform services which also provide library functions, remote management, file system, network services, time service, and backup functions. Project specific backend for data processing and analytics, together with presentation layer UI, can be developed using scripting computer language on a project-by-project basis.



This graph shows the month-by-month waste collection history for the last 12 months.

The complete WMIS includes presentation graphical applications for the Smart Displays in in-Home displays (wall-mounted iPad, Smart Mirror or Android based Video Door Phone), Lift Displays, Main Entrance Hall Displays, and Clubhouse Displays.

Optionally, it can also provide automatic garbage collection scheduler to reduce the manpower and enhance the efficiency for the collection process, based on the sensor inputs and historical patterns of collection data.

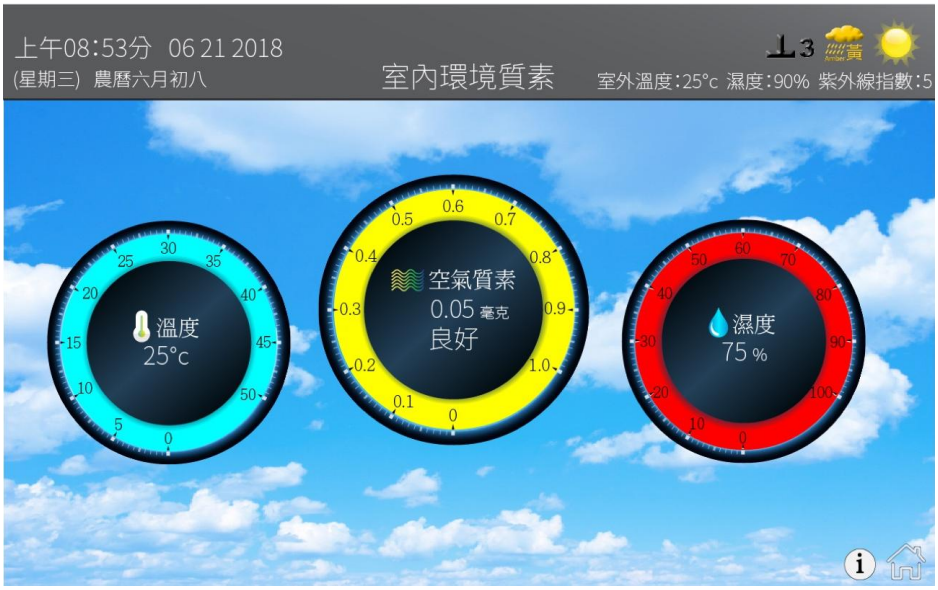
Home Health and Wellness Information System (HHWIS)

- Combined TVOC, T, rH Sensor (multi-sensors)
- Dashboard Application for displaying the dynamic graphics monitoring and control parameters
- Setting alert levels for indoor air quality when preset level (using EPD values as default) is exceeded
- Dynamic trending history report functions
- Optional automatic control of filtration fan to improve indoor air quality

The HHWIS is comprised of an indoor TVOC, temperature and relative humidity multi-sensor and corresponding application running in the GPIO2 controller.

A Carrot Multi-sensor for indoor TVOC, temperature and relative humidity.

The GPIO2 (for outdoor applications, ***enclosed it in weather-proof housing with backup power supply***), together with our embedded platform services and the Cloud form the basis of our IoT solution. The GPIO2 is equipped with numerous digital input and output ports for connection of external commercial or industrial grade sensors for data ingestion into the IoT solution. It can also act as gateway for receiving data from other IoT clients using various communication protocols for telemetry applications (such as Modbus, etc.). The data can be consolidated in its local memory for edge computing and data segregation, or optionally synchronized with the Cloud / on-premise server for data analytic solutions as necessary.



This Air Quality function shows the current total volatile organic compound (TVOC), air temperature and air humidity in the room. The red dots along the rim of the three dials indicate the temperature, TVOC, and humidity, respectively. You can set the alert level for each of these measured values by selecting the corresponding Tool Icon under each dial. The face of each dial changes color to indicate the severity of the measurement. The possible colors are blue (Low), yellow (Normal) and red (Severe).

GPIO2 provides ample local storage and edge computing capability for temporary storage of localized data subsets and as non-volatile memory for execution of the local control and automation strategies directly on GPIO2. This edge computing capability is essential when time critical response time and standalone operation (when the Cloud or internet uplink is temporarily not available).

The data collected on GPIO2 can be optionally synchronized to the dedicated Cloud / on-premise server via the embedded platform services which also provide library functions, remote management, file system, network services, time service, and backup functions. Project specific backend for data processing and analytics, together with presentation layer UI, can be developed using scripting computer language on a project-by-project basis.

Optionally, with the Automatic Control function executed from the GPIO2, the solution is capable of using the sensor inputs to control actuators and flow equipment (such as, dampers, and fans) to maintain measured variables to certain set-points, such as improving IAQ readings.

The complete end-to-end HHWIS comes with power supplies and the network connectivity to the building backbone.

Building Management System (BMS)

- **Hardware platform independent** Graphical User Interface (GUI) console and compatible with Smart Displays
- **Customizable** using **scripting language** with little efforts to adopt dynamic graphics to different screen resolution and media
- Apps for **IOS** and **Android** mobile platforms
- Web-kit Applications for other computing platforms
- Provide control, monitor and health check for various electrical and mechanical equipment inside the building
- Use GPIO2 as field controllers
- Integration to the WMIS
- Electronic noticeboard function and management functions for the notices from the Building Manager
- Displaying of Lift position and direction
- Clubhouse facility booking system
- Optional efficiency enhancing application for optimizing and notifying the **maintenance schedule** based on inputs from field sensors
- Optional integration of Building Information Modelling (BIM) as-built model for facilities management, tracking records of maintenance and other reporting via the BIM models.

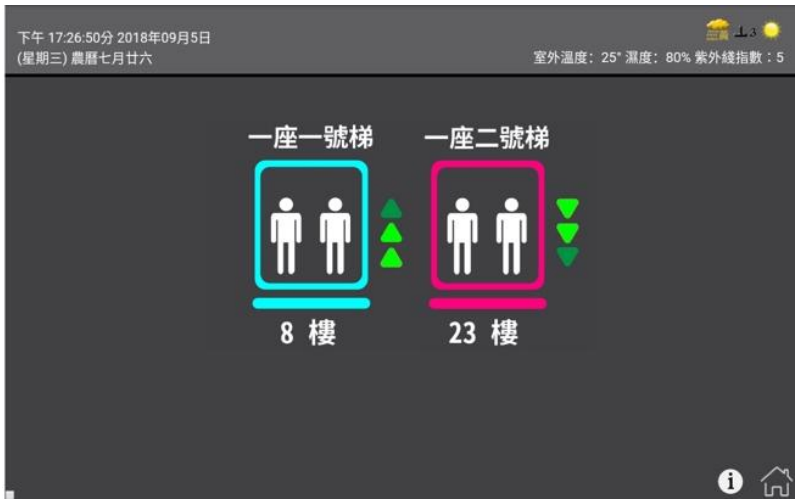
The BMS is an integrated web-based GUI application whose primary audience is the Building Manager of the building. The frontend can be conveniently run on various computers and mobile devices, including Smart Displays. The electrical and mechanical system is interfaced through the GPIO2 as field controllers, making use of its ample edge storage, or if necessary, synchronizing data with the Cloud or another on-premise server.

Various software applications are also provided:

1. Electronic noticeboard frontend for Smart Displays and the backend management function for the notices to be used by Building Manager

This Notice Board function displays all the current news and events of this estate. By selecting any of the entries, you can read in more details about the news or event.

2. Application for displaying the real-time lift positions and directions



This screen shows the current locations and travelling directions of the lifts.

3. Club house facility booking system frontend for the residents to check and reserve the facilities, and the backend programs for the clubhouse operator to release the facilities

This Facility Booking function allows you to reserve online time slots for the Yoga room, Multi-function Room, and Gym Room. Please select from the corresponding tabs on top of the screen for the facility you want to book. Then, choose the date and time slots. Enter the Resident's information and payment method. Finally, please confirm.

4. Automatic maintenance scheduler based on field controller inputs
5. Waste collection scheduler to optimize the collection time
6. CCTV camera viewers

By selecting any of the CCTV camera locations shown, you can view the real-time video from that camera.

The complete end-to-end BMS comes with power supplies and the network connectivity to the building backbone.

Integrated Control System

Integrated Control System

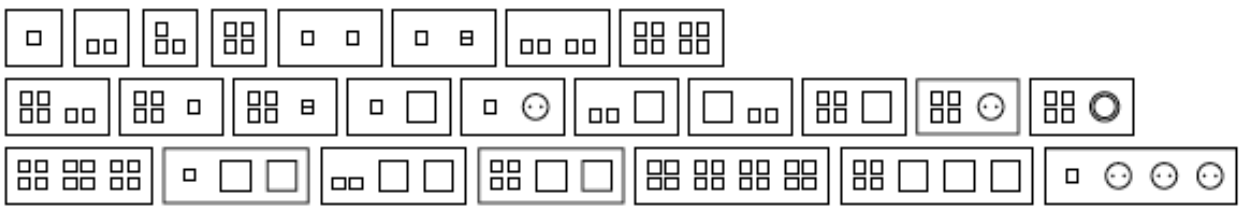
- *Wired keypad for whole-house control of lighting, dimming, curtain and other equipment*
- *More refined look & responsive control*
- *Your choice of third-party keypad faceplates*
- *Allow custom interior design*
- *Different combination and personalization options*
- *Many finish and framing materials*
- *Ideal for single house whose owner prefers control cablings instead of wireless*

A combination of ergonomics and elegance, a balance between function and form, an ultimate in simplicity and sophistication, the design of Carrot Integrated Smart Home brings home automation to a new level.

Carrot Home's award-winning team combines and brings to the table the expertise of the business of home automation and decades of experience in lifestyle design industry to create a Smart Home for your modern luxury home.

To begin with, one custom-design keypad with engraving labels is all you need at one location. No more cluttering up the wall with many light switches.

It is **User Friendly**. Use the keypad as you would any ordinary switch. The exquisitely crafted keypad combines all automated control on a single device. You can control your lights, curtains, or even air conditioning, floor heating and dehumidifier from a single panel. All functions clearly labelled and logically laid out.



Then **comes the smart part**. You can create your own custom scenes for the perfect ambience and automate your routines. Our GPIO2 Home Automation Controller, with ESD protection and lightning strike protection, supports mobile apps on IOS and Android, as well as web-based control interface for control and management of all system functions.

The GPIO2 is equipped with numerous digital input and output ports for connection of wired keypads, external commercial or industrial grade sensors for data ingestion into the data engine for analytic purpose. Moreover, the GPIO2 can also perform as a gateway for receiving data from other equipment using various communication protocols, such as Modbus, for VRV air conditioning control, lift control and indoor air quality/energy/utility consumption monitoring.

Green, Environment and Sustainability

At Carrot Home, we promote both environmental and sustainable efforts through smart living. Through the use of our applications, you can effortlessly **time schedule** your appliances and energy use to suit your lifestyle.

For air conditioning, you can use integrated schedulers and occupancy sensors to detect and help select the most energy efficient settings. Light level sensors and occupancy sensors can be used together to optimize the use of artificial lighting at home. Light level sensors can also be used in conjunction with motor curtains to keep the home cool should the sensor detect strong sunlight coming into the home.

Indoor Air Quality, Power and Utility Consumption. We are also able to integrate intelligent monitoring systems to create awareness to the users in the amount of energy and utility consumed within the premise, or the indoor air quality which is fast becoming one of more widely watch metrics to measure the wellness of a building or interior space.

For remote control, the users can download our IOS and Android app, connect via our secure GPIO2 home automation controller and use their smartphones or tablets as remote controllers.

For those who want wall-mount touch screen, we provide beautifully designed wall mount that can function as power charger. It features a user lockable design and it can be rotated in either portrait or landscape orientation.

The Autonomous Caretaker Robot

- *Autonomous Caretaker Robot is used for greeting at resident tower lobby*
- *Staircase and lift access is locked down and needs authentication to pass*
- *Grant access by smartphone App via Bluetooth Low Energy*
- *Grant access by face recognition*
- *Natural voice input for connecting visitor to resident at home*
- *Control of entrance door and lift system*

On-on, an autonomous system, makes extensive use of a technology called "Simultaneous Localization and Mapping" (or SLAM for short) that enables the robot to continuously construct and update a map of the local environment while simultaneously keeping track of the robot's location within it.

Our software application gives On-on the intelligence to navigate within this environment while using face recognition and/or Bluetooth beacon technologies to recognize whether the individual entering the premise is a resident or visitor. On-on, through its wireless connectivity to the lift control system, can then summon the lift for the residents and grant him access to the destination floor. In the case of a visitor entering the premise, On-on will move automatically to intercept him and offer to connect him to the unit he wish to visit. The visitor can use the onboard touch screen to input the unit number or directly say it by voice. On-on will use speech recognition to process the command. Upon confirmation from the unit's resident (via his intercom), On-on will proceed to summon the lift for the visitor.

On-on can also monitor its own power level and connect itself to the power source autonomously during non-peak hours so it can maintain sufficient reserve during peak times.

Additional Note: under this autonomous caretaker robot scenario, On-on will be in fact the access control for the premise. The lift access privilege is granted by face recognition, by carrying a Bluetooth beacon, by carrying a smartphone with the necessary credential, or by remote control from the intercom inside the unit. The lift destination buttons are disabled inside the lifts. Also, the doorways to the staircases are allowed for exit only.

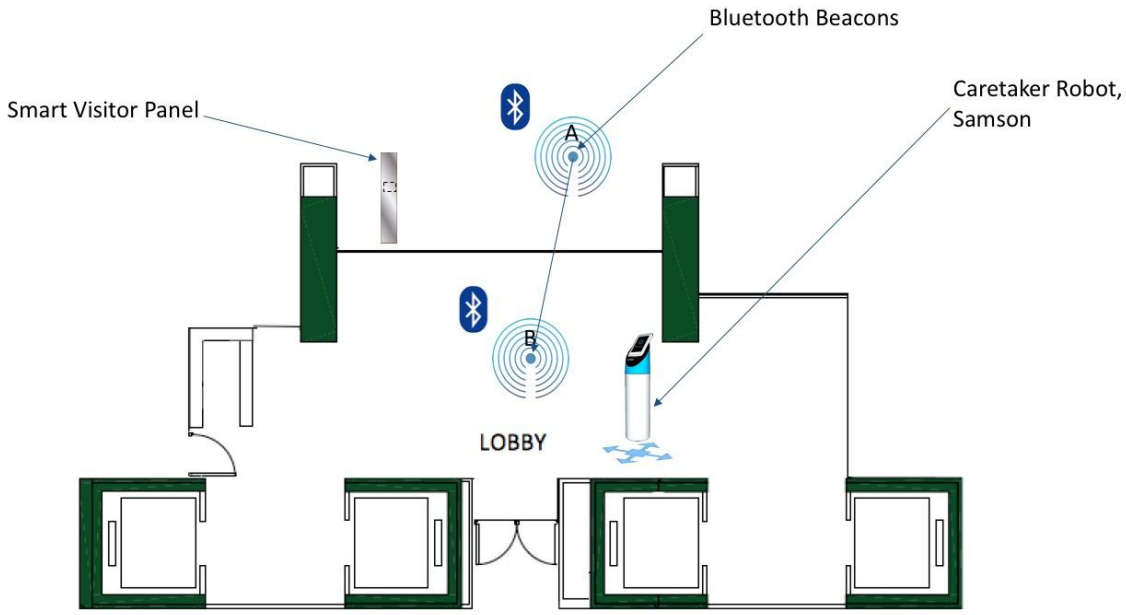


Figure 1:
For this Smart Building Access Control solution, we will install a Bluetooth Beacon for main entrance door release and lift calling. A Smart Visit Panel is used to provided 2-way video intercom between residents and visitors. These calls are received via mobile Apps only.

An Autonomous Caretaker Robot is operated in the lobby to greet the visitors, connect them to the residents or even to welcome visitors into the clubhouse.

This lift lobby will be provided with WIFI and internet connectivity is to be supplied by others.

The lift call buttons are locked and accessed by RF cards or beacons only. The staircases are secured with push-bars for exiting from inside only.

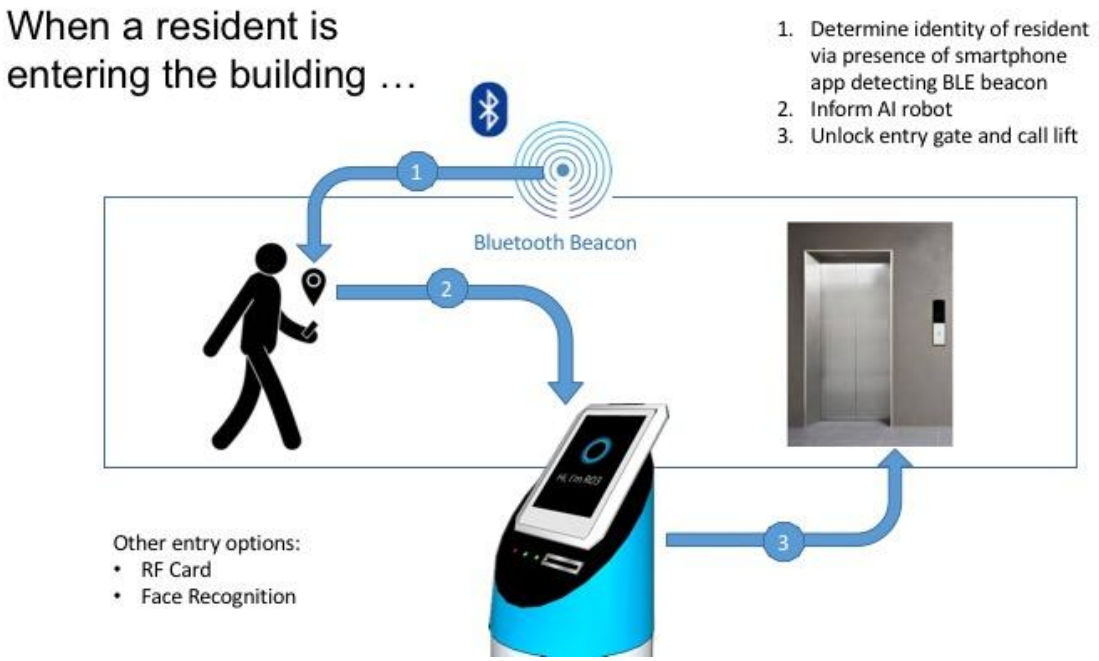


Figure 2:
There are two case scenarios in this lift lobby. Figure 2 describes the situation when the residents return to this building. Conveniently, they can use Bluetooth on their smartphones (long range) or proximity RF cards (near field) to gain access into buildings. Optional face recognition can be added for token-less access as well.

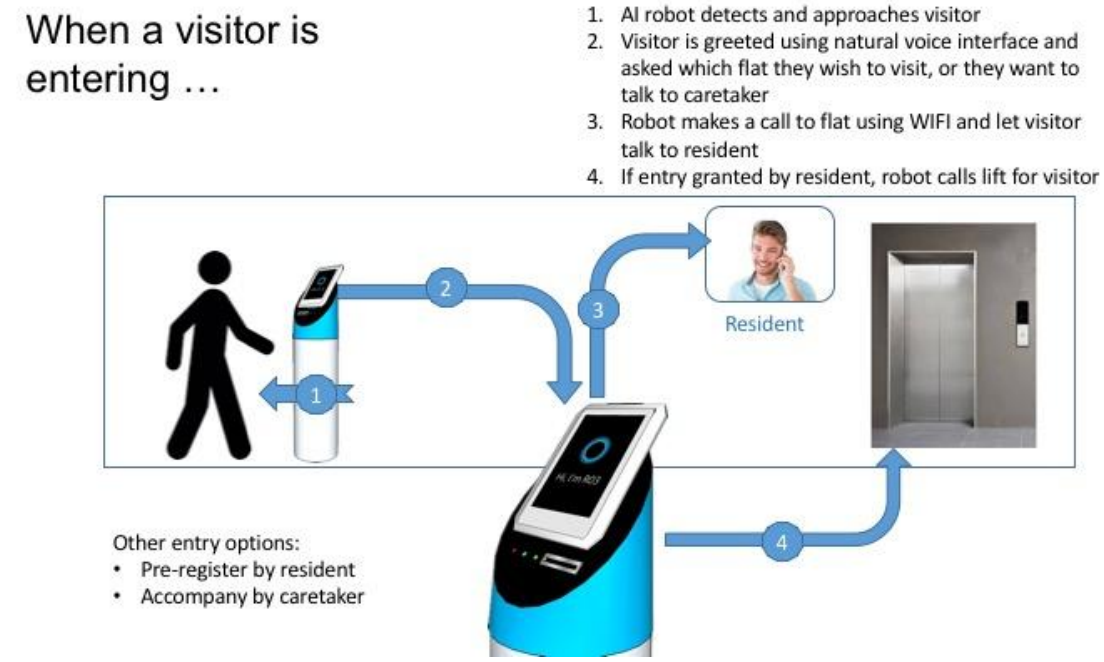


Figure 3:
Figure 3 describes the situation when a visitor wishes to enter into this building. Designed for unmanned lift lobby where no guard/caretaker is posted. The robot will approach and greet the visitor autonomously and offer to connect him to either the residents (via their smartphone App) or to a remote caretaker. Lift is called when access is granted by either the residents or the caretaker.

Smart Visitor Panel (SVP)

- *No need to install video door-phone in each of the Unit*
- *Resident receives video call via smartphone App*
- *Standalone visitor panels with mirror finish and touch screen*
- *On-screen keypad and voice recognition to enter call address or say "caretaker" or "management" to connect directly to property management at a remote location*
- *No need to install building backbone for intercom; only internet connection required at installed location*
- *LAN, WIFI or 4G Data connections supported*
- *Speak to connect - use voice to speak out which unit the visitor wants to make a call to*
- *Optional Face recognition to open door for residents / call lift for visitors*
- *Optional interface to lift system, caretaker station*
- *Optional QR code printer for visitor registration*

SVP is a stationary version of On-on whose primary function is to provide access control for a fixed entry point into a premise. Its extensive use of AI technologies enables it to provide the most user-friendly user experience for the residents and visitors going into a building, while at the same time, minimize or eliminate the needs for stationing of personnel solely for watching the entrance.

For example, the residents of the building can download a smartphone app and when they are properly authenticated, the app will automatically identify the residents whenever they approach the Bluetooth beacons located at the entry points. Network commands will be sent to unlock entrance doors or even call the lifts for them as they return to the building.

Alternatively, the residents can also choose to use RF cards or face recognition to unlock the entrance by standing in front of the SVP.

For visitors entering the premise, they will stop in front of the SVP, which normally just display a welcome message over its stylish mirror surface. Upon detection of a face, the SVP will pop up a UI prompting the visitors for either a flat unit address to call or be connected to the management office. Natural voice can be used, so the visitor can just say 12A, caretaker, management, reception and the system will understand automatically.

Alternatively, they can also present a pre-registration QR code given to them by the resident to grant entrance or they can select the on-screen icon for a keypad mode where the SVP will work much similar to a traditional system.

One game changing aspect of the system is since the residents can receive the intercom call via their smartphones, there is no need to install video door phone units inside every flat unit, thus reducing the system cost significantly.

At the same time, the use of internet and the Cloud instead of building out a dedicated, on premise backbone network, dramatically lower the cost of ownership for operating such a system. The Cloud based solution allows for remote diagnostics, monitoring and maintenance which should lower the operation costs even further.

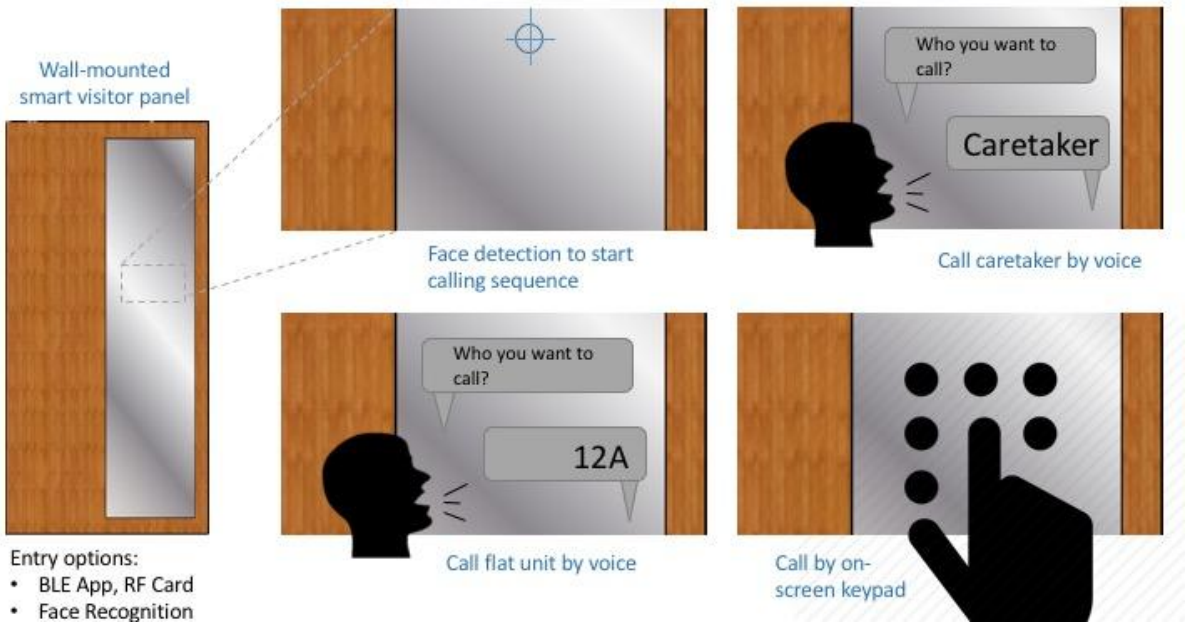
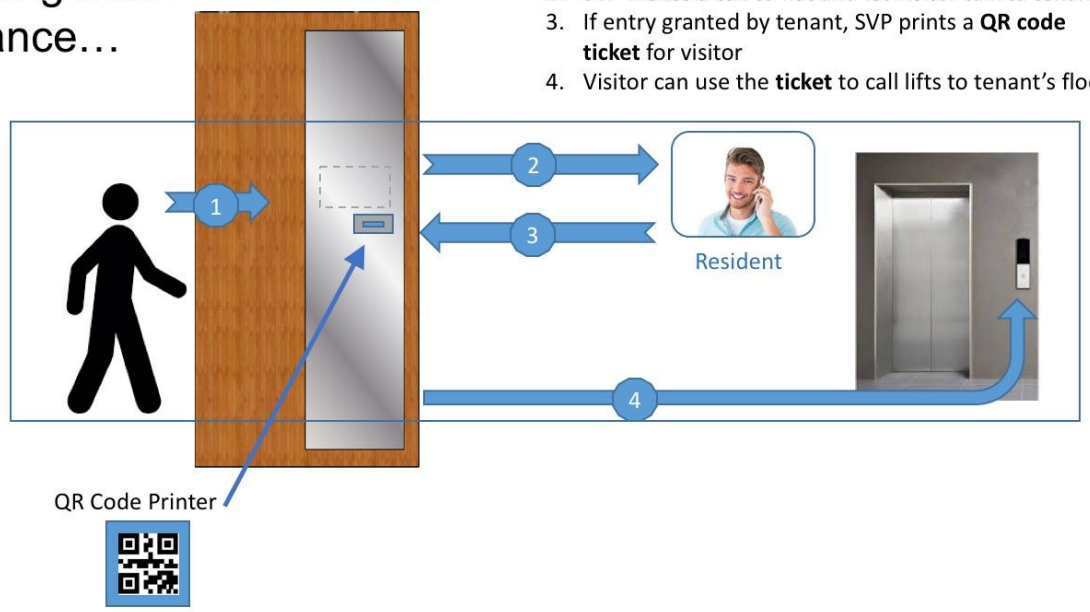


Figure 4:
Figure 4 describes the use scenario for visitor calling the residents at the main entrance.

Smart Visitor Registration System

When a visitor is entering main entrance…



1. Visitor can make calls from SVP to tenant or caretaker using natural voice commands
2. SVP makes a call to flat and let visitor talk to tenant
3. If entry granted by tenant, SVP prints a **QR code ticket** for visitor
4. Visitor can use the **ticket** to call lifts to tenant's floor

When a visitor is inside lobby …

1. AI robot detects and approaches visitor
2. Visitor is greeted using natural voice interface and asked which flat they wish to visit, or they want to talk to caretaker
3. Robot makes a call to flat using WIFI and let visitor talk to tenant
4. If entry granted by tenant, robot prints a **QR code ticket** for visitor
5. Visitor can use the **ticket** to call lifts to tenant's floor

Smart Clubhouse Management System

- *Automated facility booking system (web and App based)*
- *Smart lock for release of facility using Bluetooth*
- *AI Greeting Robot for guest check-in*

The smart clubhouse autonomous solution, On-on, makes extensive use of a technology called “Simultaneous Localization and Mapping” (or SLAM for short) that enables the robot to continuously construct and update a map of the local environment while simultaneously keeping track of the robot’s location within it.

Our software application gives On-on the intelligence to navigate within the clubhouse environment while using face recognition and/or Bluetooth beacon technologies to recognize whether the individual entering the clubhouse is resident or visitor. On-on, through its wireless connectivity to the smart locks installed at the entrance to various facilities, can then grant the residents access to his booked facility. In the case of a visitor entering the premise, On-on will move automatically to intercept him and offer to connect him to the resident who is now at the clubhouse. The residents can then come out to accompany the visitors into the facilities. On-on will use speech recognition to process the commands.

On-on can also monitor its own power level and connect itself to the power source autonomously during non-peak hours so it can maintain sufficient reserve during peak times.

Additional Note: under this autonomous greeting robot scenario, On-on is best worked with a Clubhouse Booking System and Smart Lock System. Both of which are available to be purchase separately.

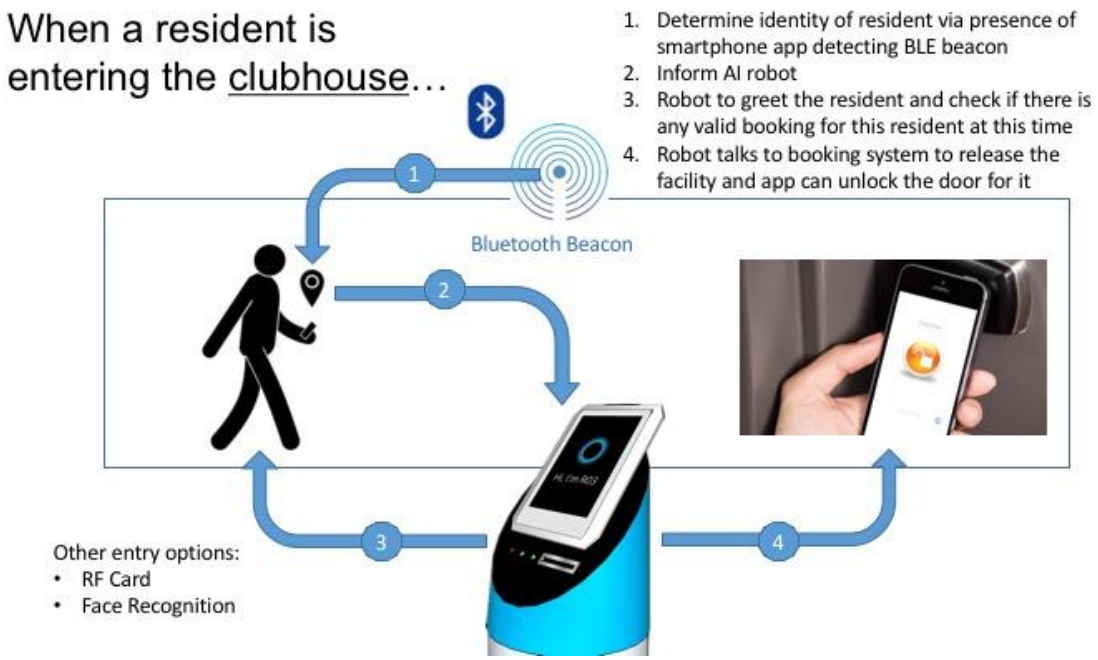


Figure 5:
There are two case scenarios in this lift lobby. Figure 5 describes the situation when the residents enter the clubhouse. Conveniently, they can use Bluetooth on their smartphones (long range) or proximity RF cards (near field) to gain access into clubhouse. Any facility booking by the resident can be released by the robot and, if smart locks are installed, the door to those facilities can be unlocked automatically. Optional face recognition can be added for token-less access as well.

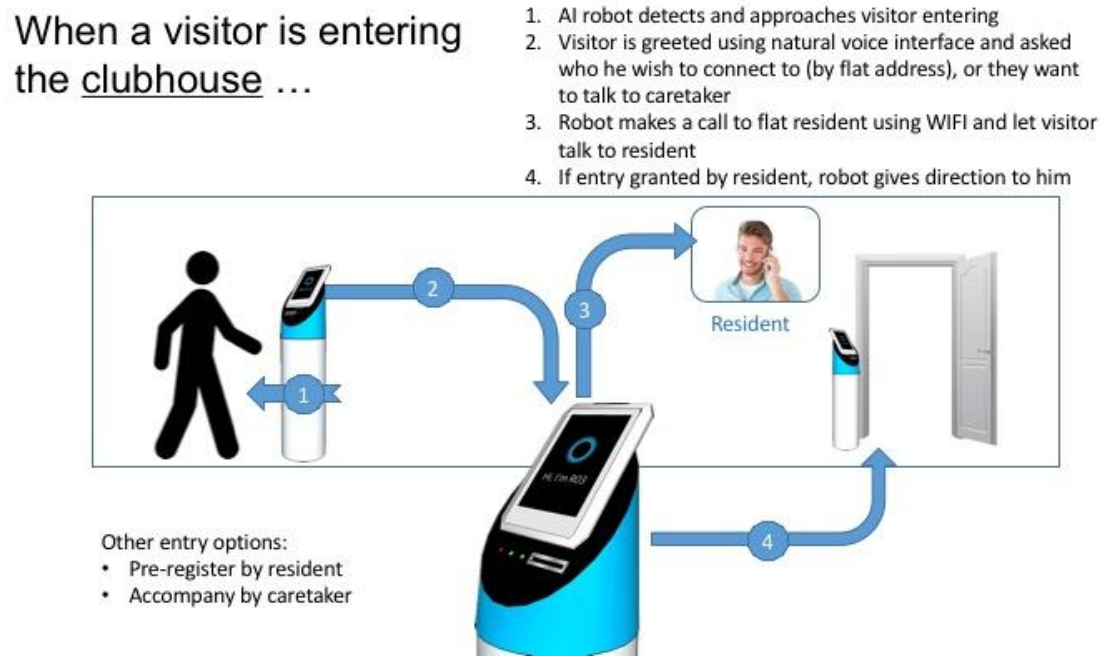


Figure 6:
Figure 6 describes the situation when a visitor wishes to enter the clubhouse. The robot can help greet the guests, connect them to the hosts and show the guests to the facilities.

Smart Key Mobile App (S-Key)

- *Built-in Mobile App Client for Video Door-phone to SVP*
- *Built-in Bluetooth Beacon Tracker for Resident ID*
- *Work with Main Entrance Access Control*
- *Work with Integrated Lift Control System*
- *Work with Integrated Car Park Barrier Gate*
- *Can be integrated with automated facility booking system (web and App based)*
- *Work with Smart lock for release of facility using Bluetooth*
- *Can be used by resident for pre-registration of visitors* ***(using QR code)***
- *Optional Panic Alarm and E-notice functions*

The S-Key is a mobile App that can be used as a replacement for video door-phone system. It works entirely over the internet without the need for laying an expensive backbone for a traditional video intercom system.

S-Key is also used as a Bluetooth Beacon Tracker that can unlock main entrance door, call lift or raise vehicle barrier gate over long range wireless connection.

S-Key also offer value-added functions such as booking system, panic alarm and e-notice services.

Carrot Home Solutions Limited

Address:
14/F, Block B, Vita Tower,
29 Wong Chuk Hang Road,
Hong Kong

Telephone: +852 2876 2198
Email: manlam@carrot-home.com
Web: www.carrot-home.com