

# Research on intelligent building application

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## Abstract

It is the development trend of the design industry to integrate intelligent building contents into the modern architectural design process. Building the future do you want to be comfortable space environment is not through the way of energy consumption, but looking for a new road, the new road through the data required to exploit the renewable resources system management and regulation, to achieve a better space and comfortable experience. The application of intelligentization to the building is in line with the future development of the building. This article from the perspective of the application of intelligent building, the current in the intelligent building case study, to explore the development trend of energy saving building, looking for the future design vision, provide theoretical basis for the actual construction.

## Keywords

Architecture, intelligence, design, sustainable development.

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## 1. Introduction

Intelligent building is refers to the buildings as a platform, through the integrated application of intelligent information, meet people, architecture, environment the effect of three aspects: harmony, theory originally was born in the early 1980 s, belong to the inevitable product of the information age, is building the future development direction. Intelligent application in architectural design, which aims to realize high building low-power effect the properties of the application of the most current performance direction there are several, including climate resources into life energy technology, intelligent technology reference, selection of new materials and scientific intelligent architecture system, integrated application of intelligent equipment, etc. Nowadays, there are cases of intelligent construction projects built at home and abroad, which provide technical guidance for the application of intelligent technology in architectural design.

## 2. Application of ground source heat pump system in climatic conditions

It is an expression of intelligent building to convert the climatic resources into the design method of living energy based on the climatic conditions. In the application of climate resources, the ground source heat pump system appears in people's field of vision.

### 2.1 Principle of ground source heat pump system

Ground source heat pump is a kind of using simple layer of geothermal resources of underground air conditioning systems, can be heating or cooling, the main use of underground soil and surface water temperature, through the system control air conditioning effect, its working principle is to realize low temperature thermal energy to heat transfer, such as in winter to take out the underground thermal energy supply construction by raising the temperature after heating; The heat from the building is taken out in the summer and released underground. The working principle is shown in Fig.1. Its application can achieve the effect of high efficiency and energy saving, it belongs to renewable energy,

and the long-life benefit is significant, and the underground converter of ground source heat pump has a life span of at least 50 years. In the future, this technology can be widely used to replace the air-conditioning system and eliminate the damage to the ozone layer by the air conditioning refrigerant freon.

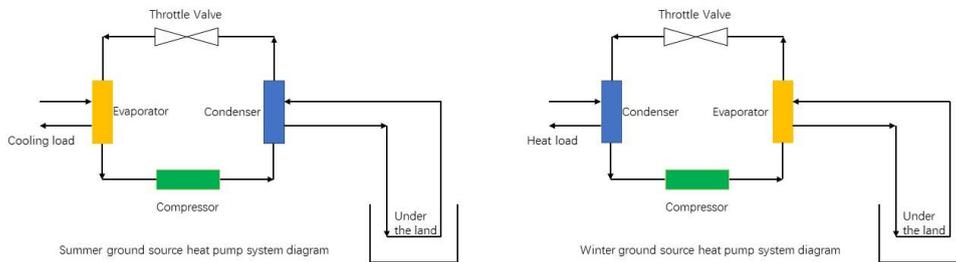


Fig.1. Ground source heat pump technology system diagram

**2.2 Application of ground source heat pump system in architecture**

In southern China is rich in water resource, in WENZHOU, for example, it east faces the east China sea, rivers and lakes is numerous, the traditional residents like the buildings built in accordance with the water, its have natural humanistic conditions, very suitable for construction and popularize the application of ground source heat pump system. The surface water source heat pump system can be tried to supply the energy of the water source to the surrounding construction group. At present, the Shanghai world expo performing arts center building is the best to use the river water for refrigeration. For the north of the Yangtze river in China, the source heat pump can be tried. The earth's shallow surface soil temperature is usually around 18 degrees centigrade, but when building construction, water pipes can be infiltrated underground, and the soil temperature of 18 degrees Celsius can be extracted through water circulation in the water pipe. In winter, it is only necessary to heat up the extracted water temperature by 10 degrees centigrade, which can be transported to the building for heating, which can guarantee the winter temperature at 20 to 22 degrees Celsius. In the summer, the extraction of 18 degrees of water directly affects buildings, which can reduce the indoor space of about 35 degrees Celsius to about 25 degrees. While energy saving and environmental protection, the ground source heat pump system also has better economy, the development prospect is broad. Taking a high-end apartment in Beijing as an example, the economic comparison between the cold and heat source of the ground source heat pump system and the conventional refrigeration heating system is carried out. The total construction area of this case is 88000 square meters, and the heating and air-conditioning area is 70,000 square meters. As can be seen from table 1, the construction cost of ground source heat pump system is 1.5% less than that of traditional central air-conditioning and gas boiler system, and the annual operating cost is reduced by 43.6%.

During the application of ground source heat pump system in northeast China, it can be built with the resources of permafrost. Such as permafrost period around 250 days throughout the year in Harbin, heihe and yichun in permafrost, in such a climate, but the deep underground permafrost extraction of low temperature heat pump system, summer cooling time for application, reduce energy consumption by architectural space, built the energy efficient and environmentally friendly construction is more suitable for human life.

Table1. Comparison table between ground source heat pump system and conventional system

System cost		Underground water source heat pump system		Traditional central air-conditioning and gas boiler system	
		Unit price (yuan /m)	Total price (ten thousand yuan)	Unit price (yuan /m)	Total price (ten thousand yuan)
investment	Equipment cost	224	1572	219	1534
	Construction cost	136	952	147	1029
Combined meter		360	2524	366	2563
Annual operating expenses	heating	12.9	150.1	26.23	266.2
	refrigeration	8.5		11.81	

### 3. The application of solar energy resources in intelligent buildings

At present, the mature intelligent technology should be the collection and utilization of solar energy resources. Such as solar water heater, photovoltaic skylight, photoelectric visor, cladding, photovoltaic roof panel, glass curtain wall and solar lamps and lanterns, etc., so much about the utilization of solar energy equipment appeared in the life. The collection and utilization of solar energy resources is a way to transform the climate resources into the energy of living, which is the future development direction of the new type of building design. At present, relevant application cases are used for reference, converting solar energy into thermal energy, and then using it to supply hot water, heating, thermal power generation, cooling, and natural ventilation.

#### 3.1 Hunan sun star city project

In domestic intelligent building projects, this project is very useful for solar energy utilization. This project for local-style dwelling houses building, has 50000 square meters in every building roof of amorphous silicon thin film solar photovoltaic power generation device, the device can convert light energy into electrical energy, and can undertake shade when needed, the application of the device makes the power supply basically self-sufficient community. Sunlight by collecting device, the heat collected underground heat preservation water tank for the storage, winter heating, through the thermal channel flows through the house floor radiant heat medium in the pipeline, in the ground, for radiator, evenly heating the whole ground, reduce other heating energy consumption.

#### 3.2 The hamerby lake city project in Sweden

The Hammarby project was completed in 2015, just south of the central city of Stockholm, and developed an old industrial zone and dock into an environmentally friendly modern residential community. It enjoys a high international reputation, this project is the core reason is driven by the government, the relevant parties together to participate in the success of ecological planning and design, the content including the lower energy consumption, use of renewable resources and water cycle use, etc. Its building energy consumption is only half the energy consumption of ordinary buildings. For example, in the Sickla Kanalgränd, two buildings are equipped with solar photovoltaic cells for use in public areas. In Viken's building roof, 390 square meters of solar panels are installed on the south side. They collect the sun's heat for heating the hot water. The thermal energy produced by solar panels can meet 50% of the annual hot water demand of these buildings.

### 4. Scientific architecture combines intelligent system

Can try to change in the design of future architectural modeling structure, the intelligent system is introduced into the building space, such as increasing the lighting area to the south, storage temperature box and ground source heat pump system takes up less as far as possible the use of architectural space area, join the rainwater collection device and the introduction of green plants, in material application, selection of new intelligent materials. The design concept is shown in Fig.2.

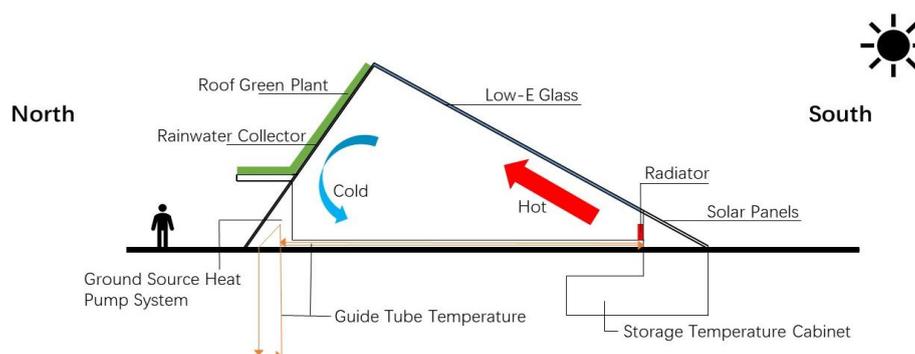


Fig.2 Design concept display

### 5. Intelligent building is equipped with new building materials

Intelligent building in the application of advanced technology technology, also began to pay attention to the introduction of new building materials. In this case, the new building materials is the use of industrial and agricultural or urban solid wastes to produce no pollution, no radioactive material, after reaching the use cycle can be recycled, and is good for human health and the environment. Today, energy saving wall, environmental protection coating, low-e glass, cement and Low carbon renewable wallpaper has appeared in the designer's view, these materials can be natural degradation and transformation, and can be used as renewable resources. In the design of Shanghai world expo zero carbon pavilion, the wall is used as an important raw material for the use of coal ash, and its thermal insulation performance is very good. The exhibition hall USES the advanced nano coating can reduce the photothermal radiation of 98%, the surface also has the self-cleaning ability. The floor is filled with ecological paint, which emits negative ions that absorb carbon dioxide from the air. The application of theonment.

### 6. Water resource recovery and reuse system

These new materials to intelligent buildings can effectively control the architectural space envire rainwater collection device in intelligent equipment is very effective in building. It is very important to find ways to increase the amount of water available. It is a good idea to collect rainwater for use. Existing related design project was carried out to explore the early, such as Germany single mothers apartment project, project through the intelligent application of water-saving technology of rain water and waste water recycling, than comparable buildings around 30% water saving.

Swedish Hammar by projects, through a discharge rainwater collection, landscape waterway construction, the rainwater collection, as part of the project waterscape, filtered in the landscape, eventually into the canal. The local Stockholm water company, the energy company and the waste disposal office, also signed an environmental and infrastructure plan to develop a recycling programme. The loop scheme is shown in Fig.3.

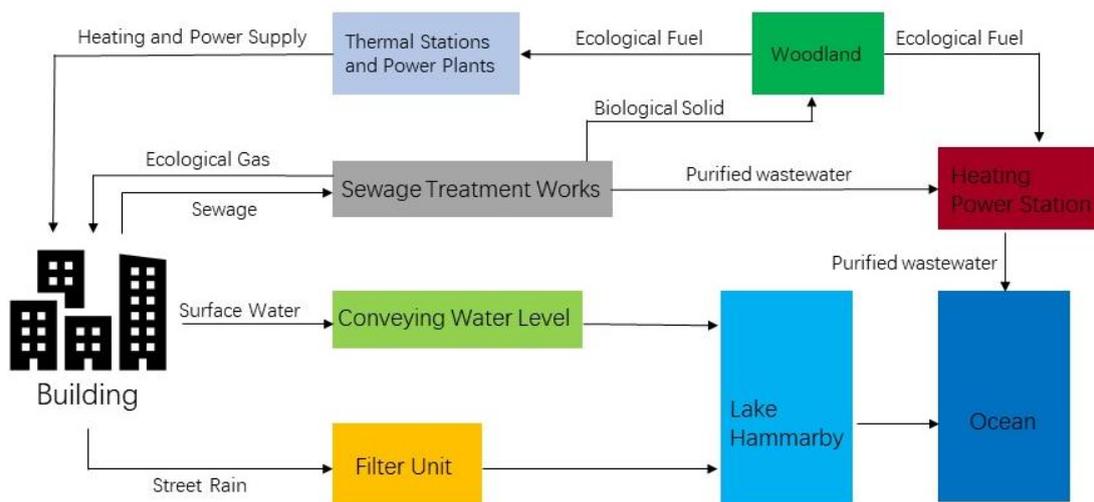


Fig.3 Circulation scheme

The use of intelligent equipment for the collection and utilization of water resources will greatly reduce the construction water expenditure and waste water resources. When the equipment system is built, the construction cost will be increased. However, from the perspective of natural protection and future cost, the final benefit value must be far beyond the initial construction.

## 7. Conclusion

In this paper, from the direction of the intelligent building application study, through the analysis of present intelligent building project, find out some new ways of intelligent building design, this way of promotion can make buildings achieve good environmental protection and energy saving effect, therefore to delve into this.

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