

# Intelligent Shutter System Design of Photovoltaic Power Generation Based on Single Chip Microcomputer Control

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**Abstract.** Photovoltaic industry is a new energy industry, it uses the solar cells directly convert to electricity production, it is a new development production in the new century, it develops rapidly. In this paper, the new energy development and utilization are taken as the base, the intelligent shutter system of photovoltaic power generation is designed, solar photovoltaic system not only operates in the strong sunlight, it can also work and generate power in cloudy inexhaustibly. The environmental pollution caused by the use of solar energy will be reduced, so it is an ideal green energy. An intelligent shutter system of photovoltaic power generation is proposed based on single chip microcomputer control, photovoltaic power generation system is established based on individual family, it can provide the electricity demand in the room, of course, the intelligent shutter system also takes electricity without environmental pollution at the same time, it can meet the requirements of the intelligent home furnishing.

## Introduction

With the progress of science and technology and the rapid development of economy, the intelligent Home Furnishing, and Internet of things technology have taken a rapid development and progress, at the same time, a greener, more efficient, and inexhaustible energy source -- solar energy also enters the high-speed train of the human science and technology development, along with the rapid development of photovoltaic industry, Chinese energy industry is also faced with the "big shake", although the old energy sources cannot be discarded completely, to meet the "new energy", "energy efficiency" still has a long way to go, no doubt, the direction is right. This paper designed an intelligent louver photovoltaic power generation system based on single-chip microcomputer control, to solve the problem of primary sources and channels of clean household energy, at the same time, the design of remote intelligent control and synchronous display of status data is obtained, through the simulation experiment, it verifies the feasibility of the system design[1-3].

## Overall design scheme of system

### A System function goal

- (1) Receiving sunlight photovoltaic panels, convert solar energy into electrical energy, which is stored in the battery;
- (2) Battery electric energy can be used for the whole system operation, it is the sources of energy;
- (3) Louver system can be composed of infrared remote control opening and closing without direct contact.

### B Frame structure of system

The photovoltaic intelligent shutter system is composed of three subsystems: photovoltaic power generation system, energy distribution system, intelligent shutter system[4,5].

- (1) The photovoltaic power generation system is responsible for the portion of the received light energy into electrical energy, storage batteries are charged by direct charging, and the electric energy is stored;

(2) Energy distribution system is assigned to different power regulators respectively, electrical appliances are used, servo motor and control system are designed, and the shutter movement control center -- such as microcontroller are designed.

(3) The intelligent shutter system is responsible for the control of the owner to make the corresponding action.

The three subsystems are combined organically, it is shown in Figure 1, a complete photovoltaic intelligent shutter system is obtained.

Through the organic combination of the three subsystems, as shown in Figure 1, constitute a complete photovoltaic intelligent shutter system.

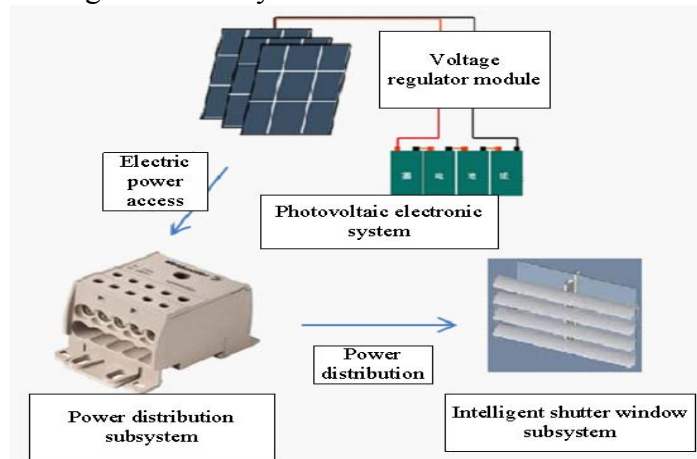


Figure 1 System structure diagram of photovoltaic power generation intelligent shutter

## Design of each subsystems

### A Photovoltaic electronic subsystem

Photovoltaic electronic system consists of photovoltaic panels with 10W power, it has voltage regulator module with real-time display, automatic up-down 12V battery etc. When photovoltaic panels receive enough light, voltage will produce some fluctuation, it needs to charge the battery, and it is composed of a voltage stabilizing module voltage to 13.5V, namely direct charging method.

(1) Photovoltaic plate of 10W power

Photovoltaic panel uses 18V rated voltage and polycrystalline solar panel with 10W rated power.

(2) Voltage regulator module

Voltage regulator module is a kind of real-time voltage display adjustable voltage regulator module with automatic lifting pressure, the output of PV panels end is connected with the input end of the voltage regulator module, output voltage regulator module end is string into the Hexapod key access battery switch, when the battery is full, it can close the regulator module output end of the Hexapod button switch, and stop charging protect for the battery.

(3) 12V battery

The 12V battery is the main energy storage component, it is the whole system energy source, two 6V5Ah connected in series in the battery.

### B Energy distribution system

Energy distribution subsystem is integrated in a block by 5V voltage regulator module and some power indicator and other peripheral circuit, input end battery access 5V voltage regulator module, the output end is connected with a six legged button switch and a power indicator lamp, it is composed of two groups of row after welded into a unified power supply area, it needs to take the electric equipment, thus module access and electric are realized.

### C Intelligent louver window system

The intelligent shutter window system is comprised with a servo motor, STC89C52 MCU development board, a buzzer circuit, infrared remote control circuit, when the infrared remote control button is pressed, the infrared receiving circuit receives the infrared signal, the I/O port of the SCM is input in the system, then the MCU decoding is obtained, signal codes are decoded into the specified letter number, the servo motor action is triggering, which can achieve remote control shutter opening and closing.

#### (1) Servo motor

The system uses a MG995 servo motor, the working voltage is .8-7.2V, work dead area is 5us, it has tension with 9.4kg/cm(4.8V), 11kg/cm(6V), the PWM pulse width control is taken, and the 20ms cycle signal is produced, the relationship between input signal and output angle of PWM pulse width is shown in Figure 2. The figure shows this experiment requires two angles of 0 ° and 45°, and 1.5ms and 2ms pulse width

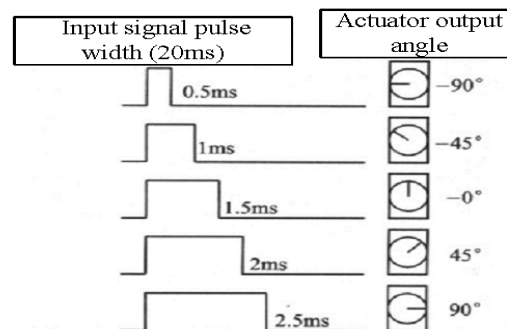


Figure 2 Relationship between input signal and output angle of PWM pulse width

#### (2) STC89C52 MCU development board

SCM is the core control components of intelligent louver window system, STC89C52 MCU development board has two external interrupts, two timer interrupts and a serial port interrupt. When the infrared is receiving head infrared signal, the signal end of the signal from the I/O input port of MCU external interrupt and trigger, it begins by decoding infrared remote control system, the block diagram is shown in Figure 3. At the same time, the timing cycle is 0.5ms, for generating a signal of PWM wave as the servo motor control, the MCU system flow diagram is shown in Figure 3.

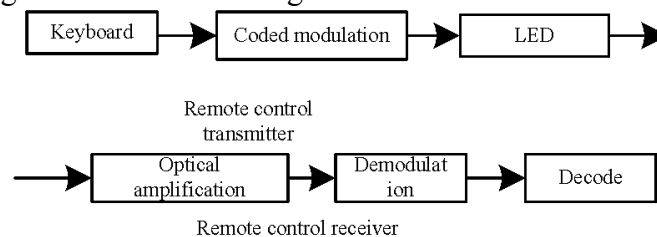


Figure 3 Block diagram of infrared remote control system

#### (3) Buzzer circuit

The buzzer circuit is composed of a non-polar buzzer, a NPN triode, 2K resistor and capacitor polarity composition, when the signal buzzer signal receives a certain frequency, it can produce sound, it is used for infrared decoding, the servo motor makes corresponding action, so it is effective to inform the operator.

#### (4) Infrared remote control circuit

Infrared remote control circuit is composed of an infrared receiving head, 10uF capacitor polarity, 200 resistor composition, when the universal infrared remote controller transmits the infrared signal, it is received by the signal receiving head, and the infrared receives head code, it will enter a series of binary code to the microcontroller, including the boot code, user ID, user identification code violation, the operation code, operation complement code. Only the operation code and operating code complement are not the same, it needs to be decoded for recognition.

## Simulation results

The simulation results complete the design requirements of the experiment basically, it includes the photovoltaic power generation system, energy distribution system and intelligent shutter system, the system design is shown in Figure 4 and Figure 5.



Figure 4. Photovoltaic power generation system

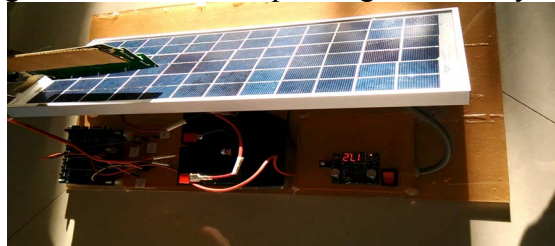


Figure 5. Energy distribution and intelligent shutter system

## Conclusion

In this paper, the photovoltaic power generation system is researched and designed, and the photovoltaic industry is a new energy industry, it uses the solar cells directly convert to electricity production, it is a new development production in the new century, it develops rapidly. In this paper, the new energy development and utilization are taken as the base, the intelligent shutter system of photovoltaic power generation is designed, solar photovoltaic system not only operates in the strong sunlight, it can also work and generate power in cloudy inexhaustibly. The environmental pollution caused by the use of solar energy will be reduced, so it is an ideal green energy. An intelligent shutter system of photovoltaic power generation is proposed based on single chip microcomputer control, photovoltaic power generation system is established based on individual family, it can provide the electricity demand in the room, of course, the intelligent shutter system also takes electricity without environmental pollution at the same time, it can meet the requirements of the intelligent home furnishing, simulation experimental results are quite satisfying.

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