Next Generation Power Generation System for Smart City
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Abstract— Combination of different but complementary energy generation systems based on renewable energies or mixed is known as hybrid system. The strategy of A "Next Generation Power Generation System for Smart City" is introduced. The system can work in poor environment for a long time. Intelligent based solar tracking generation will work high effectively when light panel trace the sun accurately. We use stepper tracking control technology which relies on control circuit with microcontroller and which can provide powerful computational capability and precise calibration. Field experience shows that tracking algorithm act stable and reliable and suit for intelligent tracking systems generation system.

Key words: Photovoltaic Cells, Tracking Systems, Intelligent Sensors, Supervisory control, battery chancing, super capacitor, pizeoenergy

I. INTRODUCTION

These days electrical generation is typically provided by fossil fuels such as coal, natural gas, and oil and also as nuclear power. Some of today’s most serious environmental problems can be linked to world electricity production based primarily on the use of non-renewable resources. Currently one third of the world population do not have access to electricity and are not connected to the national grid, one solution to this problem is renewable energy in the form of photovoltaic systems. Despite high capital cost, the systems are still a viable solution for rural areas. Studies suggest that the rate at which fossil fuels are consumed today, there are high chances that they will deplete by the end of this century.

For a long time, it has been thought that atomic energy would be a solution for the growing energy problem, but in recent times solar energy has proved to be an efficient, more secure and safe way of providing energy. Concepts related to the solar energy have constantly been under heavy research and development. The basic objective is to optimize the energy produced from photovoltaic cells, by making the overall systems more efficient and cost effective. Most solar panels are statically aligned; they have a fixed position at a certain angle towards the sky. Therefore, the time and intensity of direct sunlight falling upon the solar panel is greatly reduced, resulting in low power output from the photovoltaic (PV) cells. Solar tracking system is the solution to this issue as it plays a major role in overall solar energy optimization.

World is a storehouse of energy. We all know that energy can neither be created nor be destroyed but can be transformed from one form to another. But we are wasting resources that can produce energy as if they are limitless. If we can renew and Reuse the energy we waste, it would help in some way to the problem of scarcity of energy, which is the major threat of present world. By using the concept of wind turbines Wind-generated electricity can be used for battery charging and for connection with the power grid. Beside every fan there is a tube light by a mechanism inside the fans motor or a belt that rotates and light up the bulb or store the energy in a battery which could be used to power up other machines.

II. SOURCES OF POWER GENERATION

The conventional energy sources are limited and have pollution to the environment. For this reason more attention has been paid to the utilization of renewable energy sources such as wind energy, fuel cell and solar energy etc. Wind energy is the fastest growing and most promising renewable energy source. During last two decades, the high penetration of wind turbines in the power system has been closely related to the advancement of the wind turbine technology and the way of how to control. Doubly-fed induction machines are receiving increasing attention for wind energy conversion system during such situation [6]. Wind turbine is classified into two general types: 1. Horizontal axis and 2. Vertical axis. The limitations on the extraction of energy from the wind include the practical size of wind machines, their density, friction losses in the rotating machinery and efficiencies of conversion from rotational energy to electrical energy. A windmill works on the principle of converting kinetic energy of the wind into rotary mechanical energy. In more advanced model the rotational energy is converted into electricity [7]. Wind turbines convert the kinetic energy present in the wind into mechanical energy by means of producing torque. Since the energy contained by the wind is in the form of kinetic energy, its magnitude depends on the air density and the wind velocity. The wind power developed by the turbine is given by the equation: \( P = \frac{1}{2} \rho C_p A V^3 \), where \( C_p \) is the Power Co-efficient, \( \rho \) is the air density in Kg/m³, \( A \) is the area of the turbine blades in m², and \( V \) is the wind velocity in m/sec [6]. Hydro-electric power stations are generally located in hilly areas where dams can be built conveniently and large water reservoirs can be obtained. In a hydro-electric power station, water head is created by constructing a dam across a river or lake. From the dam, water is led to a water turbine. The water turbine captures the energy in the falling water and changes the hydraulic energy (i.e. product of head and flow of water) into mechanical energy at the turbine shaft. The turbine drives the alternator which converts mechanical energy into electrical energy. Hydro-electric power stations are becoming very popular because the reserves of fuels (i.e. coal and oil) are depleting day by day. They have the added importance for flood control, storage of water for irrigation and water for drinking purposes. The constituents of a hydro-electric plant are hydraulic structures, water turbines and electrical equipment [8].
III. DETAIL DESCRIPTION

A. Microcontroller 89c51

The AT89C52 is a low-power, high-performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel’s high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 and 80C52 instruction set and pin out. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C52 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications.

1) Features
- Compatible with MCS-51™ Products
- 8K Bytes of In-System Reprogrammable Flash Memory
- Fully Static Operation: 0 Hz to 24 MHz
- Three-level Program Memory Lock
- 256 x 8-bit Internal RAM
- 32 Programmable I/O Lines
- Three 16-bit Timer/Counters
- Eight Interrupt Sources
- Programmable Serial Channel
- Low-power Idle and Power-down Mod.

2) Pin Configurations

Port 0:-Port 0 is an 8-bit open drain bi-directional I/O port with internal pull-ups. The Port 0 output buffers can sink/source four TTL inputs. When 1s are written to Port 0 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 0 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. In addition, P0.0 and P0.1 can be configured to be the timer/counter 2 external count input (P1.0/T2) and the timer/counter 2 trigger input (P1.1/T2EX), respectively, as shown in the following table. Port 0 also receives the low-order address bytes during Flash programming and verification.

<table>
<thead>
<tr>
<th>Port Pin</th>
<th>Alternate Functions</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1.0</td>
<td>T2 (external count input to Timer/Counter 2), clock-out</td>
</tr>
<tr>
<td>P1.1</td>
<td>T2EX (Timer/Counter 2 capture/reload trigger and direction control)</td>
</tr>
</tbody>
</table>

Fig. 2

Port 1:-Port 1 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 1 output buffers can sink/source four TTL inputs. When 1s are written to Port 1 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 1 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. In addition, P1.0 and P1.1 can be configured to be the timer/counter 2 external count input (P1.0/T2) and the timer/counter 2 trigger input (P1.1/T2EX), respectively, as shown in the following table. Port 1 also receives the low-order address bytes during Flash programming and verification.

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</tbody>
</table>

Fig. 2

Port 2:-Port 2 is an 8-bit bi-directional I/O port with internal pullups. The Port 2 output buffers can sink/source four TTL inputs. When 1s are written to Port 2 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 2 pins that are externally being pulled low will source current (IIL) because of the internal pull-ups. Port 2 emits the high-order address byte during fetches from external program memory and during accesses to external data memory that use 16-bit addresses (MOVX @ DPTR). In this application, Port 2 uses strong internal pull-ups when emitting 1s. During accesses to external data memory that use 8-bit addresses (MOVX @ RI), Port 2 emits the contents of the P2 Special Function Register. Port 2 also receives the high-order address bits and some control signals during Flash programming and verification.

Port 3:-Port 3 is an 8-bit bi-directional I/O port with internal pull-ups. The Port 3 output buffers can sink/source four TTL inputs. When 1s are written to Port 3 pins, they are pulled high by the internal pull-ups and can be used as inputs. As inputs, Port 3 pins that are externally being pulled low will source current (IIL) because of the pull-ups. Port 3 also serves the functions of various special features of the AT89C51, as shown in the following table. Port 3 also receives some control signals for Flash programming and verification.

<table>
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<tr>
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<tbody>
<tr>
<td>P3.0</td>
<td>RXD (serial input port)</td>
</tr>
<tr>
<td>P3.1</td>
<td>TXD (serial output port)</td>
</tr>
<tr>
<td>P3.2</td>
<td>INT0 (external interrupt 0)</td>
</tr>
<tr>
<td>P3.3</td>
<td>INT1 (external interrupt 1)</td>
</tr>
<tr>
<td>P3.4</td>
<td>T0 (timer 0 external input)</td>
</tr>
<tr>
<td>P3.5</td>
<td>T1 (timer 1 external input)</td>
</tr>
<tr>
<td>P3.8</td>
<td>WR (external data memory write strobe)</td>
</tr>
<tr>
<td>P3.7</td>
<td>RD (external data memory read strobe)</td>
</tr>
</tbody>
</table>

Fig. 3

3) Pin Description:-
- VCC:- Supply voltage.
- GND:- Ground.

Port 0:-Port 0 is an 8-bit open drain bi-directional I/O port. As an output port, each pin can sink eight TTL inputs. When 1s are written to port 0 pins, the pins can be used as high impedance inputs. Port 0 can also be configured to be the multiplexed low order address/data bus during accesses to external program and data memory. In this mode, P0 has internal pull-ups. Port 0 also receives the code bytes during Flash programming and outputs the code bytes during program verification. External pull-ups are required during program verification.
RST:-Reset input. A high on this pin for two machine cycles while the oscillator is running resets the device.

ALE/PROG:-Address Latch Enable is an output pulse for latching the low byte of the address during accesses to external memory. This pin is also the program pulse input (PROG) during Flash programming. In normal operation, ALE is emitted at a constant rate of 1/6th the oscillator frequency and may be used for external timing or clocking purposes. Note, however, that one ALE pulse is skipped during each access to external data memory. If desired, ALE operation can be disabled by setting bit 0 of SFR location 8EH. With the bit set, ALE is active only during a MOVX or MOVC instruction. Otherwise, the pin is weakly pulled high. Setting the ALE-disable bit has no effect if the microcontroller is in external execution mode.

PSEN:-Program Store Enable is the read strobe to external program memory. When the AT89C52 is executing code from external program memory, PSEN is activated twice each machine cycle, except that two PSEN activations are skipped during each access to external data memory.

EA/VPP:-External Access Enable. EA must be strapped to GND in order to enable the device to fetch code from external program memory locations starting at 0000H up to FFFFH. Note, however, that if lock bit 1 is programmed, EA will be internally latched on reset. EA should be strapped to VCC for internal program executions. This pin also receives the 12-volt programming enable voltage (VPP) during Flash programming when 12-volt programming is selected.

- XTAL1:-Input to the inverting oscillator amplifier and input to the internal clock operating circuit.
- XTAL2:-Output from the inverting oscillator amplifier.

**B. LM7812/7805**

The LM7804 series of three terminal positive regulators are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.

1) **Working**

Voltage regulator limits the voltage that passes through it. Each regulator has a voltage rating; For example, the 7805 IC (these regulators are often considered to be ICs) is a 5-volt voltage regulator. What that means is that no matter how many volts you put into it, it will output only 5 volts. This means that you can connect a 9-volt battery, a 12-volt power supply, or virtually anything else that's over 5 volts, and have the 7805 give you a nice supply of 5 volts out. There are also 7812 (12-volt) and 7815 (15-volt) three-pin regulators in common use.

The pin out for a three-pin voltage regulator is as follows:-

1) Voltage in
2) Ground
3) Voltage out.

For example, with a 9-volt battery, you'd connect the positive end to pin 1 and the negative (or ground) end to pin 2. A 7805 would then give you +5 volts on pin 3. Voltage regulators are simple and useful. There are only two important drawbacks to them: First, the input voltage must be higher than the output voltage. For example, you cannot give a 7805 only 2 or 3 volts and expect it to give you 5 volts in return. Generally, the input voltage must be at least 2 volts higher than the desired output voltage, so a 7805 would require about 7 volts to work properly. The other problem: The excess voltage is dissipated as heat. At low voltages (such as using a 9-volt battery with a 7805),
this is not a problem. At higher voltages, however, it becomes a very real problem and you must have some way of controlling the temperature so you don't melt your regulator. This is why most voltage regulators have a metal plate with a hole in it; That plate is intended for attaching a heat sink to. Do not confuse three-pin voltage regulators with a device known as a TRIAC (short for triode AC switch). It is easy to associate them with each other, since they look similar (both have three pins) and they both regulate power. However, the 78XX type of regulators are used for regulating DC current, while TRIACs are used for AC current.

C. Relay

Transistors cannot switch AC or high voltages (such as mains electricity) and they are not usually a good choice for switching large currents (> 5A). In these cases a relay will be needed, but note that a low power transistor may still be needed to switch the current for the relay’s coil.

D. RS-232 Male/Female Connector

1) Description

RS-232 is interface for carry information between two devices distance of up to 20 meters. The information is carry along patch wires higher voltage than is standard 5V for greater interference immunity. Data transfer is asynchronous with closely set transmission speed and synchronization by trailing edge start pulse.

2) Purpose of RS-232

The RS-232-C interface was developed for a single purpose, unambiguously stated by its title: “Interface Between Data Terminal Equipment and Data Communications Equipment Employing Serial Binary Data Interchange.” Every word in the title is significant: it describes the interface between a terminal (DTE) to a modem (DCE) for the transfer of serial data.

3) Voltage levels

RS-232 using two voltage levels. Logical 1 and 0. Logical 1 is sometimes calling as marking estate or quiescent state too, logical 0 is calling as space estate. Logical 1 is indicating negative level, while logical 0 is indicate positive level. Allow voltage levels are state in table. The Noise Margin Issue Signals traveling along the cable are attenuated and distorted as they pass. attenuation increases as the length of the cable increases. This effect is largely due to the electrical capacitance of the cable. The maximum load capacitance is specified as 2500pf (Pico farad) by the standard. The capacitance of one meter of cable is typically around 130pf, thus the maximum cable length is limited to around 17 meters.

E. MAX 232

1) General Description

Serial RS-232 (V.24) communication works with voltages (-15V ... -3V for high [sic] and +3V ... +15V for low [sic]) which are not compatible with normal computer logic voltages. On the other hand, classic TTL computer logic operates between 0V ... +5V (roughly 0V ... +0.8V for low, +2V ... +5V for high). Modern low-power logic operates in the range of 0V ... ±3.3V or even lower.

IV. Analysis of the Results

A. Breaker Characteristics

The breaker control can be configured automatically by using the Timed Breaker Logic component, or the Sequencer components. The breaker may also be controlled manually through the use of on-line controls, or through a more elaborate control scheme. When the breaker logic is 0, it means breaker is closed and if the breaker logic is 1 then the breaker is open. It can be shown from the graph below.
B. Generator Output Curves

When Only Hydro Power Generator is connected: From the graph it is seen that hydro power generator generates power depending upon the load which is connected to the system. But it will change due to load variation in the system. When the load is 3 MW the generation of hydro power source is also 3 MW which can be shown from the graph. If another 2 MW fixed load is connected in the system for 0.1 sec (t=0.1sec to t=0.2sec) then power output is 5 MW in the interval t=0.1sec to t=0.2sec.

C. Field Voltage Characteristics

To investigate the dynamic behavior of a hybrid system during disturbances, a single line-to-ground (SLG) fault is modeled employing the PSCAD fault logic. The fault duration is of 0.3 sec (t=7s to t=7.3 sec). The system has returned to the normal operation condition after clearing the fault at 7.3 sec. Field voltages acting on both the generators are shown on the graph. It is clearly indicated that the fast change on the field voltage during the fault helps to restore the voltage stability of the system.

D. Equivalent Coal Consumption Calculation

In PSCAD the amount of coal which can be saved through the year can be calculated. This is very much important to use renewal and green energy instead of fossil fuel (coal). The output from the circuit has shown in the graph. The amount of coal is used to produce 10 MW is approximately 592 Kg. This is clearly shown in the two graphs.

V. Conclusion

In this work a hybrid power generation system is designed which shows different characteristics of the system. From the study of the model characteristics it is clear that this hybrid power system provides voltage stability and automatic load sharing capability. For these reasons the system is very much useful to provide good quality of power.
REFERENCE