



Comparision Between Different Solar Tracking System and Wireless Technology

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Abstract: In an attempt to fulfill the ever increasing demand for electricity with the limited sources of fossil fuel and growing concern over increasing pollution have pushed mankind to explore new non-conventional, renewable energy resources such as solar energy, wind energy, etc. Solar energy is inexhaustible and eco-friendly and can be converted into electricity using photovoltaic panels. These panels can be fixed on a ground at a particular angle or can be used in a solar tracking system. In solar tracking system solar panel is made to rotate either in single axis or in dual axis. In a single axis system the panel is moved in an east to west direction with respect to the sun and in a dual axis system the panel is made to rotate in all four directions in accordance with the sun.

Keywords— Solar panel, irrigation system, LDR sensor, moisture sensor.

I. INTRODUCTION

India receives sunlight all 12 months of a year. Hence utilizing it in the different fields is a wise idea. India is an agricultural country. India ranks second worldwide in farm output. At present, farmer manually irrigates land at regular interval. This process sometimes consumes more water or sometimes the water reaches late due to which the crops get dried. Solar powered automatic irrigation system not only overcomes this problem but also provide clean source of energy. Solar power irrigation system can be done using moisture sensor/ using wireless technology like Bluetooth, zigbee and gsm.

I. COMPARISION

A. SINGLE AXIS TRACKER

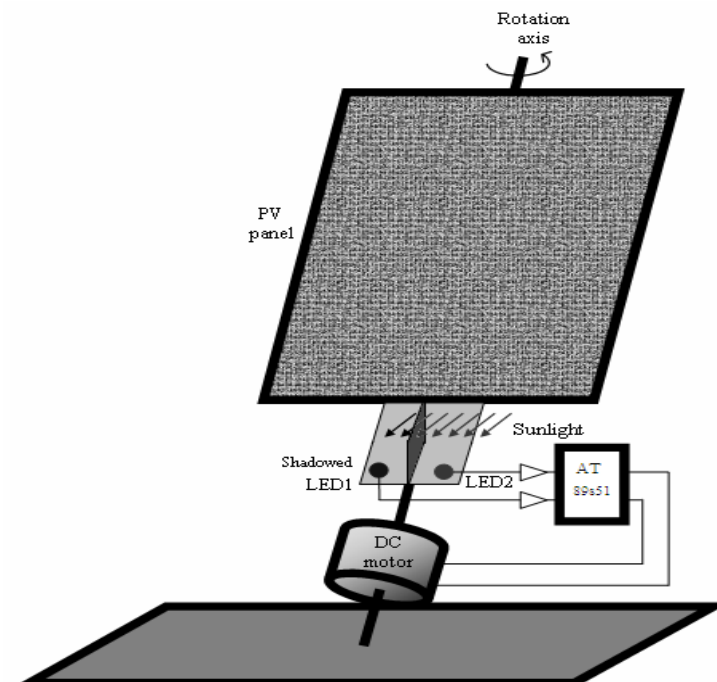
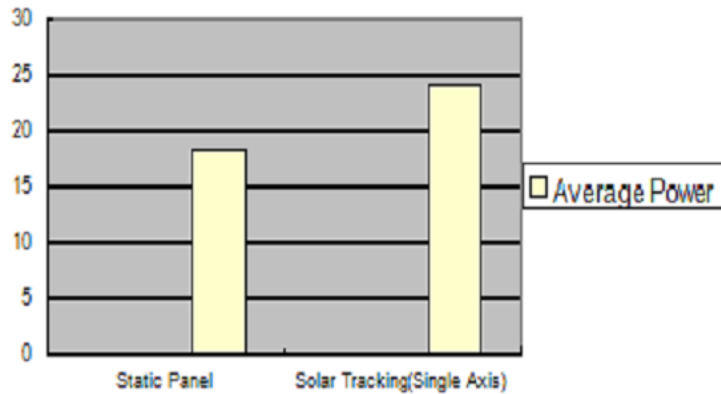


Fig 1. Principle of Single Axis Solar Tracker

Single axis solar tracker device, on the basis of LDR sensor values, orients the solar panel in accordance with the position of the sun. This system tracks the sun only from east to west direction.

Advantage:

- i. Compare to solar panel in fixed form, single axis solar tracker has better efficiency. The efficiency of single axis solar tracker over fixed mount panel is 32.17%.



Disadvantage

- i. Single axis solar tracker tracks sun only from east to west direction.
- ii. It's efficiency is less compare to dual axis solar tracker

B. Dual Axis Solar Tracker

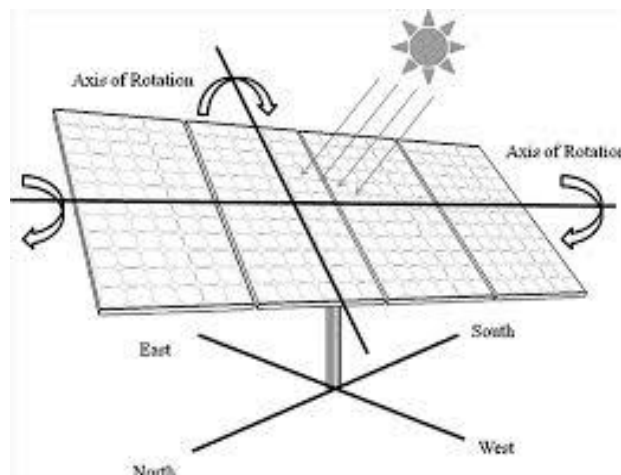
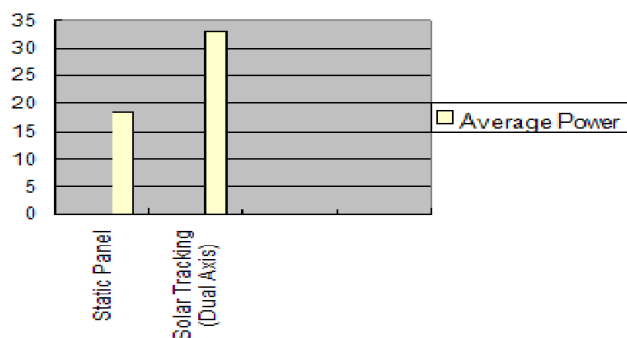


Fig 2. Principle of Dual Solar Tracker

Dual axis tracking system uses the solar panel to track the sun from east to west and north to south . The dual axis tracking system uses four LDR's, two motors and a controller. The four LDR's are placed at four different directions. One set of sensors and one motor is used to tilt the tracker in sun's east - west direction and the other set of sensors and the other motor is used to tilt the tracker in the sun's north-south direction. The controller detects the signal from the LDR's and commands the motor to rotate the panel in respective direction.

Advantage:

- i. Dual axis solar tracker have more efficiency than both fixed panels and single axis solar tracker system.



Disadvantage

- i. More complex circuit design than single axis solar tracker and fix mount solar panel.

III COMPARISION

A. BLUETOOTH

Bluetooth, also known as the IEEE 802.15.1 standard is based on a wireless radio system designed for short-range and cheap devices. This range of applications is known as wireless personal area network (WPAN). The range of Bluetooth communication is 10m.

B. ZigBee

ZigBee over IEEE 802.15.4, defines specifications for lowrate WPAN (LR-WPAN) for supporting simple devices that consume minimal power and typically operate in the personal operating space (POS) of 10m. ZigBee provides self-organized, multi-hop, and reliable mesh networking with long battery lifetime .

C. Wi-Fi

Wireless fidelity (Wi-Fi) includes IEEE 802.11a/b/g standards for wireless local area networks (WLAN). It allows users to surf the Internet at broadband speeds when connected to an access point (AP) or in ad hoc mode.

Table 1.COMPARISON OF THE BLUETOOTH, ZIGBEE, AND WI-FI PROTOCOLS

PARAMETERS	BLUETOOTH	WI-FI	ZIGBEE
IEEE SPECIFICATION	802.15.1	802.11a/b/g	802.15.4
FREQUENCY BAND	2-2.4GHz	868/91MHz ;2GHz	2.4GHz;5 GHz
Max signal rate	1mb/s	54mb/s	250kb/s
Nominal range	10m	100m	10-100m
Channel bandwidth	1 MHz	22MHz	0.3/0.6 MHz; 2 MHz
Max number of cell nodes	8	2007	>65000
Number of RF channels	79	1/10; 16	14

A. Radio Channels

Bluetooth, ZigBee and Wi-Fi protocols have spread spectrum techniques in the 2.4 GHz band, which is unlicensed in most countries and known as the industrial, scientific, and medical (ISM) band.

Bluetooth- Use frequency hopping, channels79, BW- 1MHz

ZigBee- Use Direct Spread Spectrum, channel-16, BW-2MHz.

Wi-Fi- Use Direct Spread Spectrum, Complementary Code Keying or OFDM, channels-14, BW-22MHz.

B. Coexistence Mechanism

Since Bluetooth, ZigBee and Wi-Fi use the 2.4 GHz band,the coexistence issue must be dealt with. Basically, Bluetooth provide adaptive frequency hopping to avoid channel collision, while ZigBee and Wi-Fi use dynamic frequency selection and transmission power control.

C. Network Size

Bluetooth- 8 number of devices that can be connected in network

ZigBee- More than 65000 devices can be connected in a network

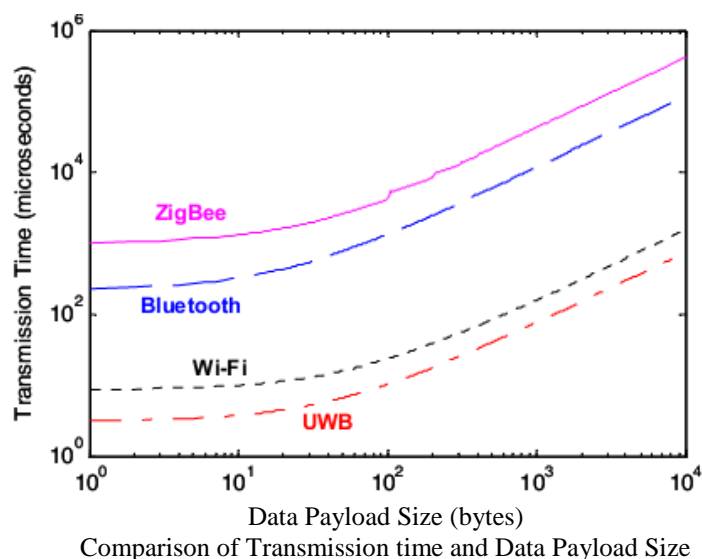
Wi-Fi- Over 2007 devices can be connected in a network.

D. Security

Bluetooth- Uses the E0 stream cipher and shared secret with 16-bit cyclic redundancy check (CRC).

ZigBee- Adopt the advanced encryption standard (AES)block cipher with counter mode (CTR) and cipher block chaining message authentication code (CBC-MAC), also known as CTR with CBC-MAC (CCM), with 32-bit and 16-bit CRC.

Wi-Fi- Uses the RC4 stream cipher for encryption and the CRC-32 checksum for integrity.



IV. Conclusion

This paper has presented the broad view of different types of solar tracking system viz. single axis solar tracker and dual axis solar tracker with their advantages over the fixed mount solar panel. Dual axis solar tracker has greater efficiency than single axis tracker and fixed mount panel but its circuit is complex and require high cost. Single axis solar tracker tracks the daily movement of the sun but not the yearly movement. Since yearly movement of the sun is very minimum, designing of the single axis solar tracker will be wise deal. The converted solar energy can be used for different applications like irrigation. Solar power irrigation can be done using wireless technologies like Bluetooth, ZigBee, Wi-Fi. GSM can also be used to ON and OFF the irrigation pump which is powered using solar energy.

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