# WIRELESS SOLAR TRACKING SYSTEM USING ARM 11



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## AIM:

The aim of the project is to design "Embedded Solar Tracking Embedded System".

## COMPONENTS:

ARM11 kit, Solar Panel, LDR, Zigbee.

## ABSTACT:

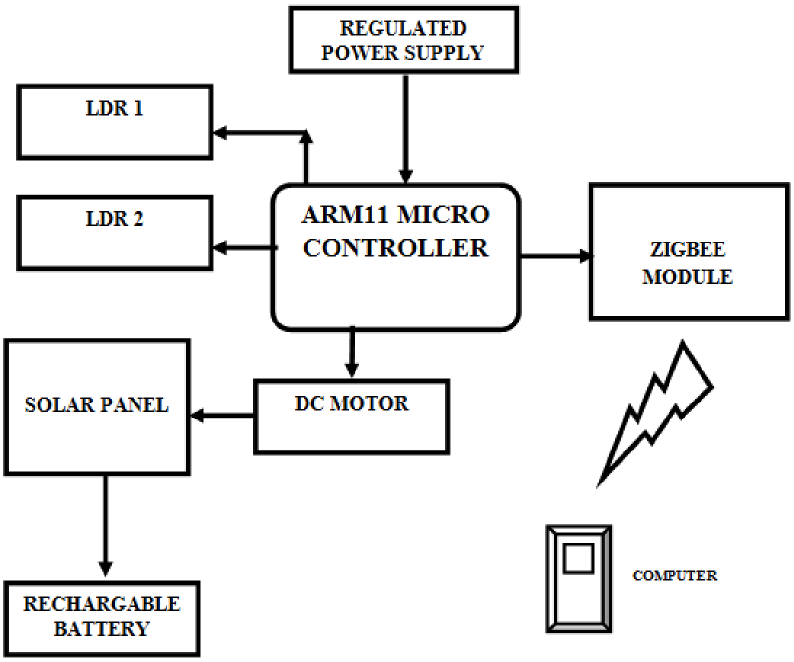
In order to solve the problem of solar tracking and monitoring in solar power system, our embedded system is designed and develop the Solar tracking and data acquisition of ARM11 micro controller and principle of serial/zigbee communication. A solar panel is a packaged connected assembly of photovoltaic cells. The solar panel can be used as a component of a larger photovoltaic system to generate and supply electricity in commercial and residential applications. Each panel is rated by its DC output power under standard test conditions, and typically ranges from 100 to 320 watts.

Our embedded project uses solar panel which is connected to micro controller. The controller processes the information and sends the information to the monitoring center through Serial / Zigbee module.

Our embedded project is combined Zigbee wireless communication and the highly effective energy conservation chip ARM11 is presented, the system not only made the data information transmit to the monitoring center real-time and effectively, but also realized unmanned watching.

Our Embedded project is to design and develop a low cost feature which is based on embedded platform for solar panel tracking and monitoring in solar power system. Here we are using ARM11 micro Controller to implement this project.

## BLOCK DIAGRAM:



## IMPLEMENTATION:

**SOFTWARE:** Embedded 'C'
**TOOLS:** QT IDE, Linux OS
**TARGET DEVICE:** ARM11.

## INTRODUCTION:

The web technology has begun to have a rapid development in the field of embedded systems in the post-PC era. The application of embedded web technology in the remote monitoring system has given rise to the technological change in the field of industrial control. Nowadays the management of the domestic laboratories in the research institute and universities has issues of poor real time, high cost and low precision .It is difficult to determine the quality of the environment of the laboratory.

So the Laboratory Intelligent Monitoring System should be developed to implement early warning, remote control, real-time monitoring and other functions. This paper comes up with a design solution of an embedded web-based remote monitoring system for the environment in the laboratories, which realizes the local management and remote publishing applications for large-scale dynamic data of sensor networks and video images.

Here, we propose the design and implementation of lowcost web based remote monitoring system with built-insecurity features. Due to the usage of an embedded intelligent monitoring module which is the Samsung S3C2440 32-bit ARM Samsung processor as its main controller, the performance and frequency of which are suitable for real-time video image capture and processing applications.

This micro controller works for a voltage of +3.3V DC and at an operating frequency of 400 MHz, The maximum frequency up to which this micro controller can work is 533 MHz making it very much suitable for a portablesystem. Later programming is done on this Board to make itact as an embedded web server.The main objective of the system is to design "EMBEDDED SOLAR TRACKING EMBEDDED SYSTEM".

## ARM11 PROCESSOR:

ARM is a 32-bit RISC processor architecture developed by the ARM corporation. ARM processors possess a unique combination of features that makes ARM the most popular embedded architecture today. First, ARM cores are very simple compared to most other general-purpose processors, which means that they can be manufactured using a comparatively small number of transistors, leaving plenty of space on the chip for application specific macro cells. A typical ARM chip can contain several peripheral controllers, a digital signal processor, and some amount of on-chip memory, along with an ARM core. Second, both ARM ISA and pipeline design are aimed at minimising energy consumption — a critical requirement in mobile embedded systems.

Third, the ARM architecture is highly modular: the only mandatory component of an ARM processor is the integer pipeline; all other components, including caches, MMU, floating point and other co-processors are optional, which gives a lot of flexibility in building application-specific ARM-based processors. Finally, while being small and low-power, ARM processors provide high performance for embedded applications.

For example, the PXA255 XScale processor running at 400MHz provides performance comparable to Pentium 2 at 300MHz, while using fifty times less energy.

## 1.4 PROPOSED METHOD:

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## SENSORS:

### 3.2.1 LIGHT SENSOR (LDR):

A light-dependent resistor, alternatively called anLDR, photoresistor, photoconductor, or photocell, is a variable resistor whose value decreases with increasing incident light intensity. An LDR is made of a high-resistance semiconductor.

If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

Fig 3(b) Light Detecting Register

### 3.2.2 SOLAR PANEL:

A solar panel (photovoltaic module or photovoltaic panel) is a packaged interconnected assembly of solar cells, also known as photovoltaic cells. The solar panel is used as a component in a larger photovoltaic system to offer electricity for commercial and residential applications.

Because a single solar panel can only produce a limited amount of power, many installations contain several panels. This is known as a photovoltaic array. A photovoltaic installation typically includes an array of solar panels, an inverter, batteries and interconnection wiring. Photovoltaic systems are used for either on- or off-grid applications, and for solar panels on spacecraft.

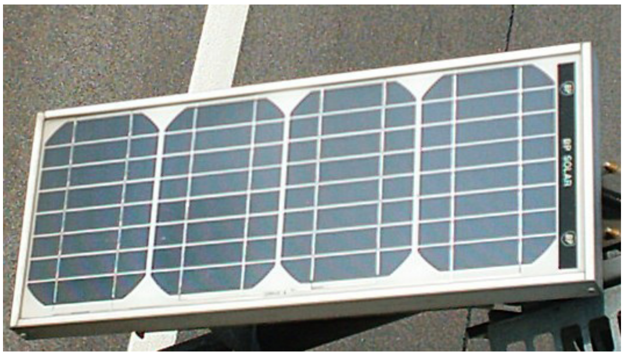


Fig: 3(c) Solar panel

(A photovoltaic module is composed of individual PV cells. This crystalline-silicon module has an aluminum frame and glass on the front.)

### Theory and Construction:

Solar panels use light energy (photons) from the sun to generate electricity through the photovoltaic effect (this is the photo-electric effect). The structural (load carrying) member of a module can either be the top layer (superstrate) or the back layer (substrate). The majority of modules use wafer-based crystalline silicon cells or a thin-film cell based on cadmium telluride or silicon. Crystalline silicon, which is commonly used in the wafer form in photovoltaic (PV) modules, is derived from silicon, a commonly used semi-conductor. In order to use the cells in practical applications, they must be:

• connected electrically to one another and to the rest of the system.

• Protected from mechanical damage during manufacture, transport, installation and use (in particular against hail impact, wind and snow loads). This is especially important for wafer-based silicon cells which are brittle.

• Protected from moisture, which corrodes metal contacts and interconnects, (and for thin-film cells the transparent conductive oxide layer) thus decreasing performance and lifetime.

Most modules are usually rigid, but there are some flexible modules available, based on thin-film cells.

Electrical connections are made in series to achieve a desired output voltage and/or in parallel to provide a desired amount of current source capability.Diodes are included to avoid overheating of cells in case of partial shading. Since cell heating reduces the operating efficiency it is desirable to minimize the heating. Very few modules incorporate any design features to decrease temperature; however installers try to provide good ventilation behind the module.

New designs of module include concentrator modules in which the light is concentrated by an array of lenses or mirrors onto an array of small cells. This allows the use of cells with a very high-cost per unit area (such as gallium arsenide) in a cost-competitive way. Depending on construction, the photovoltaic can cover a range of frequencies of light and can produce electricity from them, but sometimes cannot cover the entire solar spectrum (specifically, ultraviolet, infrared and low or diffused light).

Hence much of incident sunlight energy is wasted when used for solar panels, although they can give far higher efficiencies if illuminated with monochromatic light. Another design concept is to split the light into different wavelength ranges and direct the beams onto different cells tuned to the appropriate wavelength ranges. This is projected to raise efficiency by 50%. Also, the use of infrared photovoltaic cells can increase the efficiencies, producing power at night.

Most solar module are currently produced from silicon PV cells. These are typically categorized into either monocrystalline or multicrystalline modules.Third generation solar cells are advanced thin-film cells. They produce high-efficiency conversion at low cost .In rigid thin film modules,the cell and the module are manufactured in the same production line.The main cell technologies in this category are CdTe, or a-Si, or a-Si+uc-Si tandem, or CIGS (or variant).

Amorphous silicon has a sunlight conversion rate of 6-12%.Flexible thin film cells and modules are created on the same production line by depositing the photoactive layer and other necessary layers on a flexible substrate.If the an insulator (e.g. polyester or polyimide film) then monolithic integration can be used.If it is a conductor then another technique for electrical connection must be used.

The cells are assembled into modules by laminating them to a transparent colorless fluoropolymer on the front side (typically ETFE or FEP) and a polymer suitable for bonding to the final substrate on the other side. The only commercially available (in MW quantities) flexible module uses amorphous silicon triple junction (from Unisolar).

So-called inverted metamorphic (IMM) multi junction solar cells made on compound-semiconductor technology are just becoming commercialized in July 2008. The University of Michigan's solar car that won the North American Solar challenge in July 2008 used IMM thin-film flexible solar cells.

## ZIGBEE:

Zigbee is a low power spin off of WiFi. It is a specification for small, low power radios based on IEEE 802.15.4 – 2003 Wireless Personal Area Networks standard. The specification was accepted and ratified by the Zigbee alliance in December 2004. Zigbee Alliance is a group of more than 300 companies including industry majors like Philips, Mitsubishi Electric, Epson, Atmel, Texas Instruments etc. which are committed towards developing and promoting this standard.

The alliance is responsible for publishing and maintaining the ZIgbee specification and has updated it time and again after making it public for the first time in 2005. Most of the recent devices conform to the Zigbee 2007 specifications has two feature sets– Zigbee and Zigbee Pro. The manufacturers which are members of the Alliance provide software, hardware and reference designs to anyone who wants to build applications.


Fig 3(g) Zigbee

Many years ago, when Bluetooth technology was introduced, it was thought that Bluetooth would make Wi-Fi redundant. But the two coexist quite well today, so do many other Wireless standards like Wireless HART and ISA100.11a. Then why would we need another WPAN standard like Zigbee? The answer is, the application focus of Zigbee Alliance - low cost and low power for energy efficient and cost effective intelligent devices. Moreover, Zigbee and Bluetooth have different application focus.

Despite of all their similarities, and despite the fact that both are based on the IEEE 802.15 standards, the two are different in technology as well as scope. Bluetooth is made with mobile phones as its centre of universe enabling media transfer at rates in excess of 1 Mbps while Zigbee is built with emphasis on low data rate control system sensors featuring slower data of just 250 kbps.

ZigBeecoordinator(ZC): The most capable device, the coordinator forms the root of the network tree and might bridge to other networks. There is exactly one ZigBee coordinator in each network since it is the device that started the network originally. It is able to store information about the network, including acting as the Trust Centre & repository for security keys. ZigBee Router (ZR): As well as running an application function a router can act as an intermediate router, passing data from other devices.

ZigBee End Device (ZED): Contains just enough functionality to talk to the parent node (either the coordinator or a router); it cannot relay data from other devices. This relationship allows the node to be asleep a significant amount of the time thereby giving long battery life. A ZED requires the least amount of memory, and therefore can be less expensive to manufacture than a ZR or ZC.

## Protocols:

The protocols build on recent algorithmic research (Ad-hoc On-demand Distance Vector, neuRFon) to automatically construct a low-speed ad-hoc network of nodes. In most large network instances, the network will be a cluster of clusters. It can also form a mesh or a single cluster. The current profiles derived from the ZigBee protocols support beacon and non-beacon enabled networks.

In non-beacon-enabled networks (those whose beacon order is 15), an unslottedCSMA/CA channel access mechanism is used. In this type of network, ZigBee Routers typically have their receivers continuously active, requiring a more robust power supply. However, this allows for heterogeneous networks in which some devices receive continuously, while others only transmit when an external stimulus is detected.

The typical example of a heterogeneous network is a wireless light switch: the ZigBee node at the lamp may receive constantly, since it is connected to the mains supply, while a battery-powered light switch would remain asleep until the switch is thrown. The switch then wakes up, sends a command to the lamp, receives an acknowledgment, and returns to sleep. In such a network the lamp node will be at least a ZigBee Router, if not the ZigBee Coordinator; the switch node is typically a ZigBee End Device.

## WORKING PRINCIPLE/RESULT:

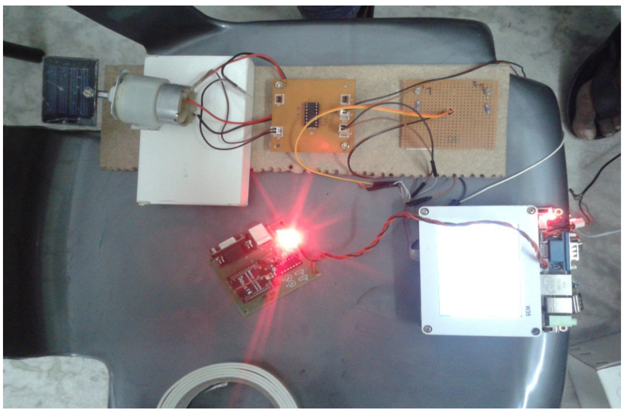

Fig 5(a) connection of circuit

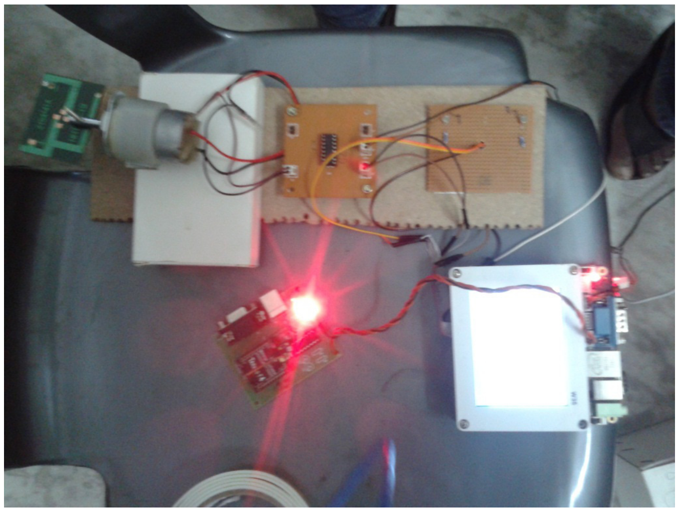

Fig 5(b) shows connection and rotation

In this circuit we can see the connection ,when the power supply is given to The Friendly ARM starts.

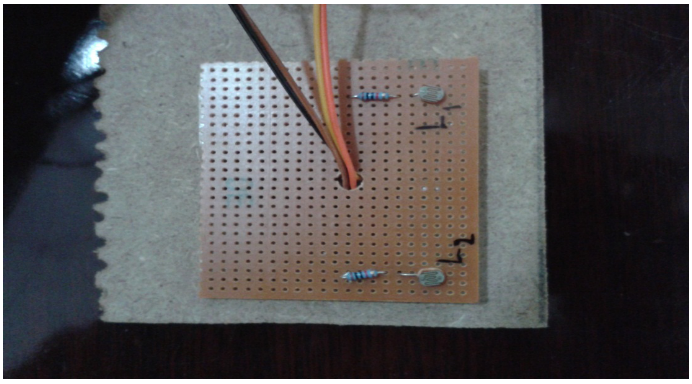

Fig 5(c) LDR 1 and 2

The LDR L1 and L2 will caliculate the intensity of sunlight and send information to friendlyARM board which inturn send information to the motor and the solar panel direction will be shifted by this we can get more sun intensity and maximum solar power will be stored.

This information will be transferred from Zigbee transmitter to the receiver which is in home and the information we can see on the computer.

## CONCLUSION:

The project "WIRELESS SOLAR TRACKING SYSTEM USING ARM 11" has been successfully designed and tested. It has been developed by integrating features of all the hardware components and software used. Presence of every module has been reasoned out and placed carefully thus contributing to the best working of the unit. Secondly, using highly advanced ARM11 board and with the help of growing technology the project has been successfully implemented.