# The Implementation of Uninterrupted Solar Surveillance System

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## Abstract

An uninterrupted solar surveillance system is investigated and implemented in the paper. It is being comprised of three subsystems which include the charging sub-system, the monitoring sub-system and the integrating sub-system. On the basis of combining wireless communication with the green energy concepts such a surveillance system were constructed, besides, the idea of WSNs (wireless sensor networks) is also included into the implementation. That is, the lifetime of a simulated WSNs system can be evaluated with the results the statistical report. Accordingly, this surveillance system can be completed to apply widely in several kinds of different applications.

***Keywords*** **:** Green energy, Solar cell, WSNs (wireless sensor networks).

## I. Introduction

Recently, on the basis of several advantages of application in the real world, such as the low cost, the easily establishment, the capacity of self-organizing, and widely deployment, sensor networks become an important role for development or application in the real world. Especially, WSNs (wireless sensor networks) are able to be widely adopted in many directions, such as healthcare, control, military command, communications, and surveillance [1]. Thus, to study issues of each layer about WSNs protocol is becoming gradually one kind of necessary, and those are including power consumption networking topology, signal processing, environment deployment, transmission Media, etc.. It is known that in sensor networks the larger number of sensor nodes can provide with the more precise results to the BS (base station). However, in order to reduce the number of parameters for systems performance, to decrease sensor nodes in a good method. Moreover, the mobility of the sensor is also an important point can be applied to solve the problem of coverage hole exists in WSNs [2]. Certainly, It is also another issue to address in combining WNSs with RFID (radio frequency identification) devices. For example, they can be combined to solve the problems of the issue in surveillance [3, 4].

On the other hand, the application of green energy is gradually seized at an important position in the industry development due to the shortage of energy. However, the issues of efficiency for a system to complete the work of green energy become important. The discussions are involving such as, the efficiency, the reliability, and even the stability of a charging system, or the lifetime of charging capability. Due to all of those important specified items, the requirement of a wireless surveillance system for applying in such a charging system is necessary. However, it is rare about the implementation for solar surveillance system with wireless methods except with the wired communication [5]. In this paper on the basis of WSNs we proposed a fresh idea to implement the uninterrupted solar surveillance system with the radio system. Since it is uninterrupted the monitoring system is also a ubiquitous system, *i.e.*, it can be located at any places where the solar system is established. On the beginning, it is just one proto-type model, and it can be commercialized after the implementation and the measurement are

completed eventually.

The organization of the paper is as follows, following the introduction section, the functions of the system implementation are described in section 2. The results from the implementation are shown in section 3. In section 4 a simple conclusion is drawn.

## II. Description of System Functions

The mainly implemented to a solar cell wireless surveillance system is constructed with the block diagram shown in Fig. 1, in which there are three sub-systems, including the charging sub-system, the monitoring sub-system and integrating sub-system, illustrated in Fig. 2, Fig. 3, respectively. The designed rules of the function are to be explained in this sub-section.

### 2.1. Sub-system for Charging

In Fig. 2, the charging sub-system is in charge of gathering the energy through the solar cell, that is, the energy will be charged by solar cell system and it will be stored in a battery. On the other hand, the charging behavior will be provided by the city power alternatively if the power can't be maintained by supported from the solar system. In order to maintain the system in capable of running and non-interrupted, some signals will be captured from the nodes of the system with the FRID (radio frequency identification) techniques. The operation of such a system is presented in Fig. 3 wherein including some components, solar cell plants which is also call PV array cell (or solar cell panel) with 260 Watt, a DC 12-V charging battery, which is considered as a about 0.5KVA battery in the charging sub-system, DC-to-DC converter which will pull the voltage up about $\sqrt{2}\times 110$ V, then this voltage will be translate to about $115$-V AC voltage, and this voltage will parallel put into the city power line that supplied by the power company. After the waveform shaper the energy generated from the charging sub-system will provide to all of the other sub-systems.

In order to detect the operating status of the system, there are 3 Tags will be appended into the sub-system. The control modular and radio modem, which will read all the data comes from the Tags.

### 2.2. Sub-system for Monitoring

In monitoring sub-system, shown in fig. 4, which tries to record and analysis the data transmitted from charging sub-system by an active embedded radio reader reading the detected data pass from the tags. There will be some tags attached in some where of charging sub system, and the active reader in RFID system will read the effective data into the server via the serial port communicates with a control server [7]. Thus, the sub-system is planned to be established with the hardware and software departments with the following components;

A set of radio modem module which is with the type of ADAM-4550 [5] and embedded with an micro-processor unit. The data rate is selected with 115.2 *Kb/sec*, the radio frequency is set as 2.442 *GHz*, radio bandwidth is 22 *MHz* in the efficient transmission distance about 550 ft, however, the transmission distance depends on the changing of the data rate, and with the RS-232 and the RS-485 communication protocol. The type of SYTAG245-TM-A [4] active reader combining with tags is adopted to detect the varying of the status of the charging sub-system. There are different ID numbers are pre-write in the Tags that is with the type number SYTAG245-TM-A and the effective distance is about 100 meters. Moreover, the adoption equipment is an active reader with the type number SYRD245-1N which is working in 2.45 GHz dual way communication frequency, it provides RS-232, RS-485 and RJ-45 communication ports, and supports the protocol of ICMP, ARP, IP, TCP/IP, UDP, DHCP, HTTP etc..

On the basis of the fact that the convenience and concurrent to modified the varying functions of the monitoring sub-system, in this stage, the @Visual Basic software [6] are applied to program all the functions which is necessary for the monitoring sub-system. The detected data captures from the Tag components, it will be watched out by the active reader then the complete information be passed to the end server via the radio modem modules with wireless communication methods.

### 2.3. Sub-system for Combination

Finally, the total system as shown in Fig. 5 and which will be implemented to integrate all the sub-system for displaying the status according to the data passed from the previously sub-system at last. The values of current, voltage, power, the system operation efficiency, and the capacity of the storage will be analyzed and shown up in this sub-system. Hereafter, all the operation efficiency of the total system can be watched out and tuned in this sub-system by using of the feedback signals. The radio modem, PC server equipped with a data base system, signal chip modular will be planned to construct in this sub-system.

One of the motivations of the paper has ever been mentioned in the section I, that is, the WSNs concepts will be includes in this project. For the purpose of evaluating the lifetime for one of sensor nodes deployed in the environment of the WSNs, some conditions are added into the integrating sub-system. Under such assumption all the consumed energy will be supported from the charging sub-system. Except the total system performance will be detected by the monitoring sub-system, there is a loading work equipped with DC-motor and stepping motor are going to run at the same time [7]. On the running way, a control panel programmed in @Visual Basic Package which has some push buttons provide with different functions to control the loading (motors), and combine with electronic circuit designed in the hardware with 8051 single-chip micro-processor and software in assembly language, respectively. Thus, the lifetime performance of each sub-system (sensor node) can be calculated simultaneously.

## III. Results

Near about 90 percentage of the full system now is completed. A proto-typing system and the simulated implementation are finished with some universal PC boards. The full integrated system is captured and shown in Fig. 6, wherein the illustration has been marked. Some rough part of the system is presented in Fig. 6, however, the objective of the full integrated system has exhibited and approached. The 16 counts receivered data will be transmitted to the server through the radio MODEM, and data the format of that comes from the reader is shown in Fig. 7. The information with the serial number shown in Fig. 7 is including RSSI, LQI, DI, and more two the temperatur status. In Fig. 8 the display screen with the coresponding data format is captured, and it is clear to see that the caught data from the Tags. The presented information in Fig. 8 can be used to detecte the status of charging sub-system. There is also a combinating sub-system in which the 8051 single chip is adopted as a central control unit, and to control a DC-motor and a stepping motor. A LCD display module is designed to monitor the situation of the sub-system itself.

In the future, the system will keep on testing the steps include combine the charging sub-system with the monitoring sub-system and the integrating sub-system. Moreover, the protyping circuit will be laid out with PCB and to become a commercial product. Besides, the performacne will be shown by some statistical report which will be established with the data collected by integrating sub-system.

## IV. Conclusions

In the paper a monitoring system for the application in solar cell charging system which called as WUMS (wireless universal monitoring system) and constructed with three sub-systems are implemented and investigated.

Some of the results from the implementation are now completed and illustrated with simulation. Since the time is tight all of the idea to complete the WUMS is still keeping on constructed and going to be published in the future with property results.

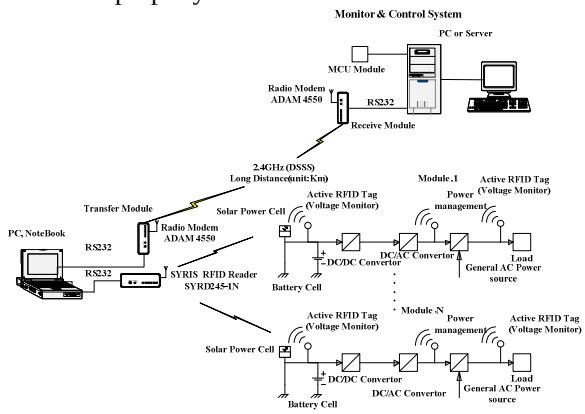


**Fig. 1 The block diagram**

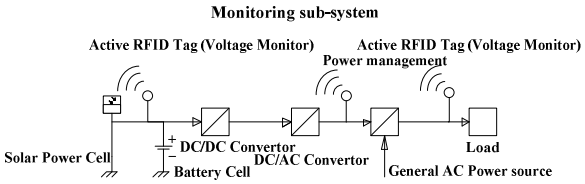


**Fig. 2 The block diagram of monitoring sub-system**

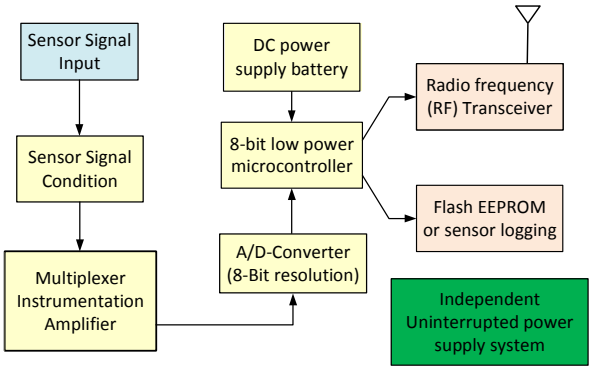


**Fig. 3 The block diagram of the charging sub-system**

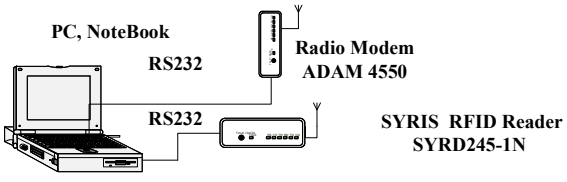


**Fig. 4 The block diagram of monitoring sub-system**

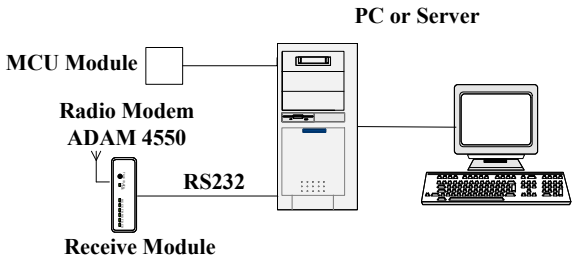


**Fig.5 The block diagram of combination sub-system**

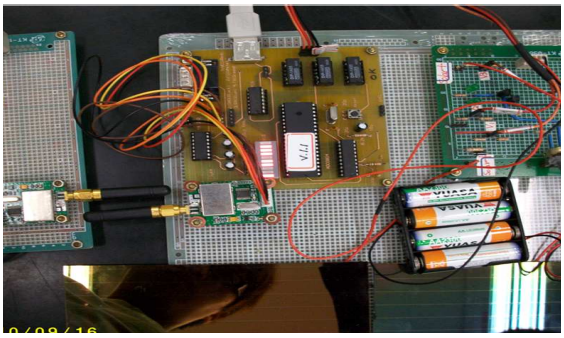

**Fig.6 The proto-typing system**

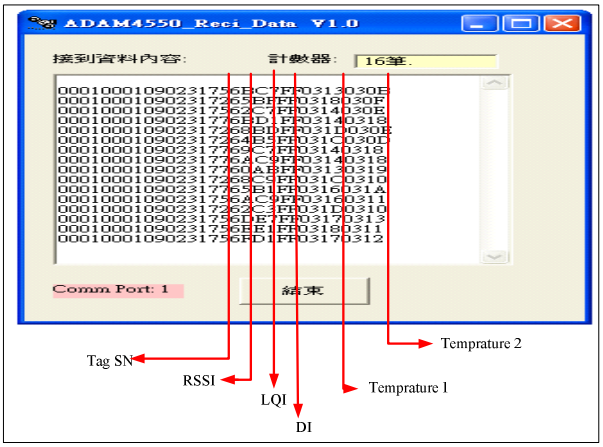


**Fig. 7 The collected data format**

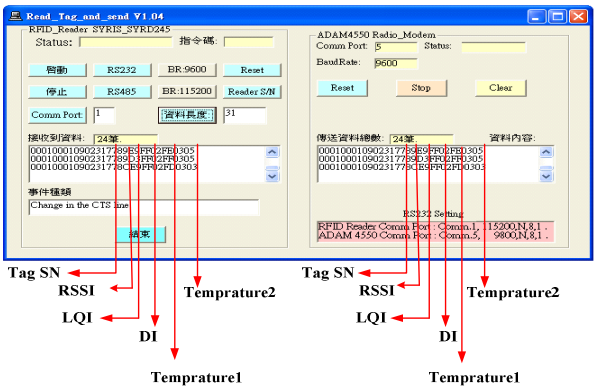


**Fig. 8 The collected data on Tags**

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