Wifi Enabled Smart Farm with Monitoring and Energy Theft Control System

Neha Noren Parshad [*], Alwin Philipose [*], Shakti Chitnis [*], Aparna Sharma [*], Kritika Pachouri [**]

[*] Electrical and Electronics, Northern India Engineering College, Delhi, India
[**] Department: Electrical and Electronics, Northern India Engineering College, Delhi, India

DOI: 10.29322/IJSRP.8.7.2018.p7981
http://dx.doi.org/10.29322/IJSRP.8.7.2018.p7981

Abstract- Automated irrigation system focuses on optimizing the usage of water in agricultural land. In this project, we aim at establishing a very fast communication link with the farmer. This makes it easy for the farmers to monitor the soil and the crop conditions from very far locations. Because of its low cost, the system has the potential to be useful in water limited geographically isolated area. This system implement the automated irrigation and it sends the sensed value of soil temperature, moisture and humidity level to the concerned person through wifi. Wifi module can work across a range of around 150m & hence can provide remote controlling for large distances. The soil temperature, moisture and humidity values will be monitored continuously. Along with the help of a Real Time Clock module all the data is saved in order to track any sudden changes. In case of any energy theft taking place in the area, a specified person will be notified by beeping of a buzzer .The energy will be produced autonomously with the help of a solar panel & solar charger using Solar Tracker consisting of Light dependant resistor diodes to track maximum intensity of photons for the solar tracker. The project is scalable as long as they work on the same server. The project will be successful in increasing the competence of various farming activities. In order to increase the ease of working in the field for the farmer an automated irrigation system is build using wifi module to control the centrifugal pumps forcing the water to the fields by using an android application.

Index Terms- Wifi, Solar Tracker, Energy Theft

I. INTRODUCTION

Nowadays there has been a vast improvement in the field of automation especially in the Home Automation sector. The automation offers us the advantage of access to system from the comfort of our home. It also leads to savings in the long run since the remote access & automation also offer the option of centralized control.

Almost all of the existing systems are based on the wired connection. The traditional systems of wired connections do not pose a problem as long as the system is planned before & installation is done beforehand.

Wireless systems are used every day in our life from home networks to office buildings. The WLAN systems are widely used in our daily life. There are several advantages of wireless systems over wired ones:

[1] Installation cost of the system is reduced: The wired systems require use of cables to provide a communication link. The wireless systems require no such use of cables & thus reducing the cost of the cables.

[2] Ease of installation & coverage: Wireless systems can be easily mounted easily anywhere. Moreover it can also be placed at any remote location unlike wired which would require use of long cables to accomplish this.

[3] Integration with smart phones: Nowadays everyone has a smartphone, thus allowing the access to almost everyone with the password of wireless network.

[4] Scalability: New modules or functions can be added easily to the existing system.

Wired connections require new node & additional cabling thus increasing cost.

Solar energy is nowadays considered an emerging field & one of the problems plaguing this field is its low efficiency. The output is still not maximised if the solar arrays are not positioned according to the position of the sun. Thus Solar Tracker is used to find the position of the array which corresponds to the maximum power generated by the solar array.

II. LITERATURE SURVEY

Recent developments in China have led to development in technology which has led to growing of off season crops in a controlled environment. These systems were based on WSN's & IP cameras were installed to monitor the growth of the crops.

Irrigation systems using GSM systems are gaining wide acceptance in developed countries like USA, England & Australia.

In Chennai, India a group of college students developed a dual axis MPPT controller which worked to provide optimum output of the solar PV array.

III. EQUIPMENTS USED

- **Arduino-UnoMicrocontroller:** Arduino Uno is used to

provide logic to the whole circuit. The whole system is managed & programmed with the help of this controller.

- **Esp-8266(Wifi Module):** To communicate with the Relay Card (which further controls the water pump), we have used the wifi module ESP-8266. This provides the internet connectivity to the whole system.
- **Temperature Sensor:** LM-35 temperature sensor is used to detect the temperature of the whole farming area.
- **Solar PV Array:** A solar PV array is used to convert the solar energy of the sun to electrical energy.
- **Current Sensor:** ACS-712 is used as the current sensor which is used in the energy theft system.
- **LCD Display:** 16 X 2 LCD is used to display the output parameters like voltage, current, total power of the solar PV array and wattage as well as energy in the energymeters used in energy theft.
- **Solar Charge Controller:** The solar panel output is connected to the whole system as well as the solar charge controller which is connected to a battery bank.
- **Relay Card:** A relay card is used to drive the centrifugal pumps in the irrigation-system.

IV. PROPOSED SYSTEM

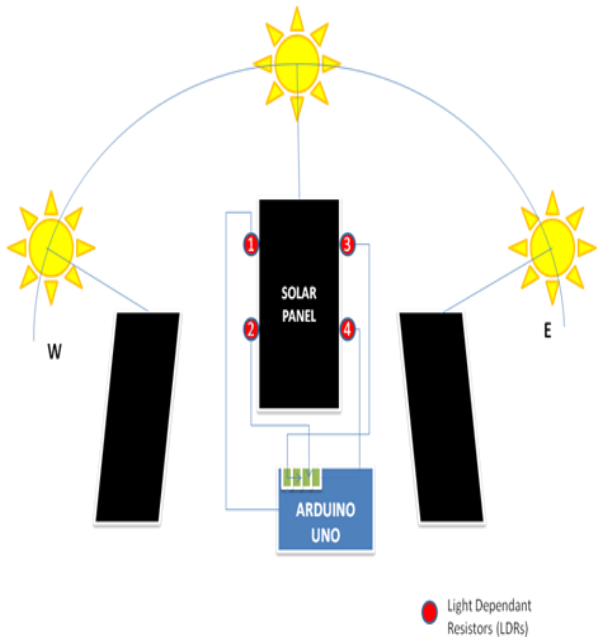
- **Irrigation System:** An irrigation system is made with the help of a water level indicator & a water pump to help with the irrigation & aeration of the plants. This system is automated using the wifi module ESP-8266. The water level indicator is used to demonstrate the water level. If the water level is substantially low, then the farmer can turn on the the water pump using the mobile application.
- **Energy Theft Detection:** For energy theft detection a system is put in which consists of two energy meters. Thus, while this system will prevent energy theft from the power source, it also displays the voltage, current as well as the power consumed by the whole system.
- **Solar Tracking System:** A solar tracking system is put in place to follow the Sun as it moves from East to West. It produces energy with the help of a solar PV cell. The panel's position according to the relative position of the sun. Two LDR diodes are connected on both sides of the solar panel to compare the intensity of sunlight on the panel then converting the electrical reading of the diodes into analog readings a logic is created to position the panels towards the higher photon intensity side.

V. PSEUDO CODE

The sun rises from east to west, if we call the LDRs present on the east side L and the LDRs present on the west side R then the code will be as follows:

servo_angle = 0^o

{
For(0^o<servo_angle<180^o)
*/*Angle range for servo motor*/*
If (L>R)
{
servo_angle= servo_angle++
*}/*During Early morning*/*
Else if (L==R)
{
servo_angle=STOPS
*}/*During Noon*/*
Else if servo_angle==180^o
{
servo_angle=0^o
*}/*Start next day*/*
}



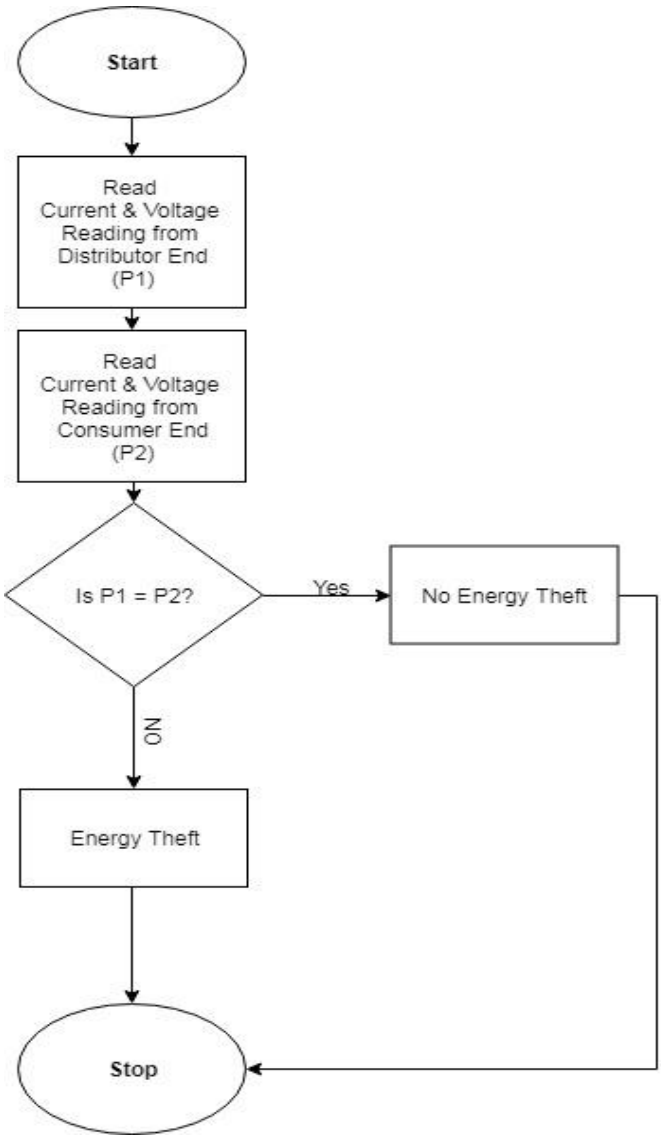
In Figure: Block diagram of Solar Tracker

VI. WORKING OF THE SYSTEM

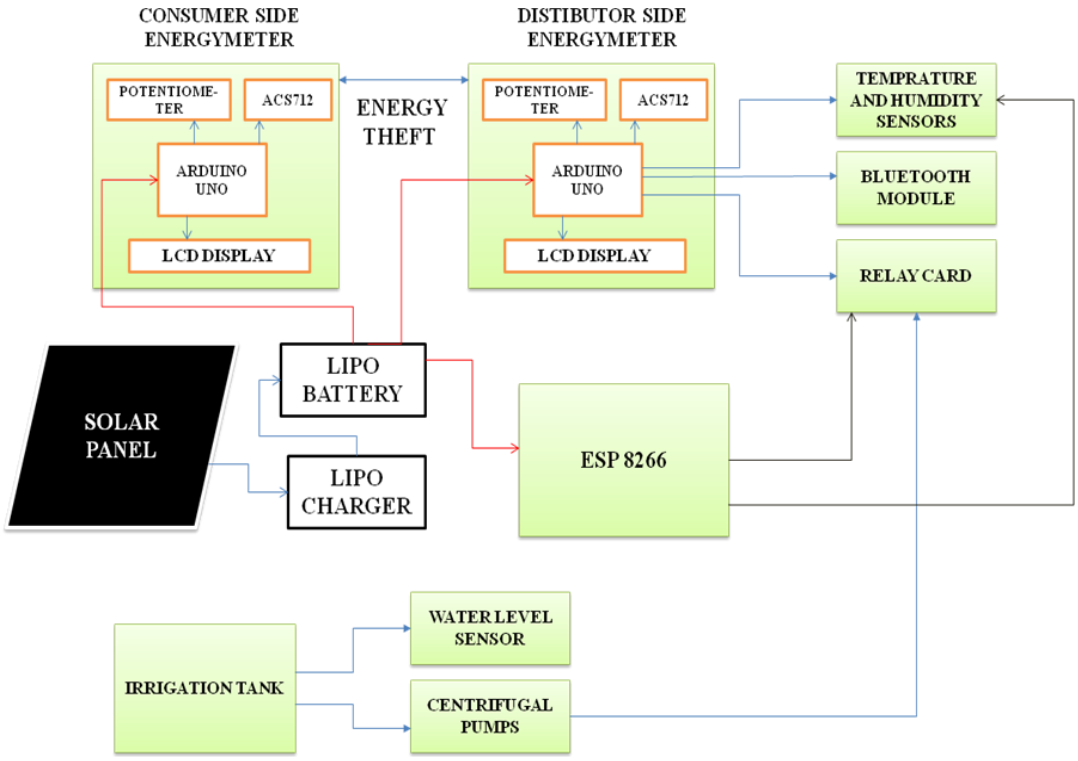
The whole system's heart lies in the microcontroller ie. Arduino Uno. A number of such microcontrollers are used to run this system efficiently. The temperature sensor & water level indicator is used to provide data to the user. The user according to the data given by the sensors can decide if the water level is low. If the user wants to increase the water level of the irrigation field, the user can turn on the irrigation pump within the comfort of home, using his/ hers mobile phone's wifi. This all reduces the effort of the farmers. An energy theft detection system has been introduced so as to detect the any sort of energy theft is going on in the system. This reduces the energy cost of the whole system which is incurred by the user. Thus this system will help in keeping the electricity bill in check. The system can alert the user of any energy theft from his power connection. This feature ensures that the user is not hurt economically.

The system also tells the user his energy consumption ie. the current, the voltage of the system, the power being consumed

& the total energy consumed by the user. Thus, the user is able to keep his expenses on energy in check. The energy obtained from the solar panels are used to charge the Lithium Polymer (LIPO) battery that is used to drive the whole microcontroller system. The solar tracker setup will be connected along with the battery to charge it simultaneously so that the system must be in the running state.



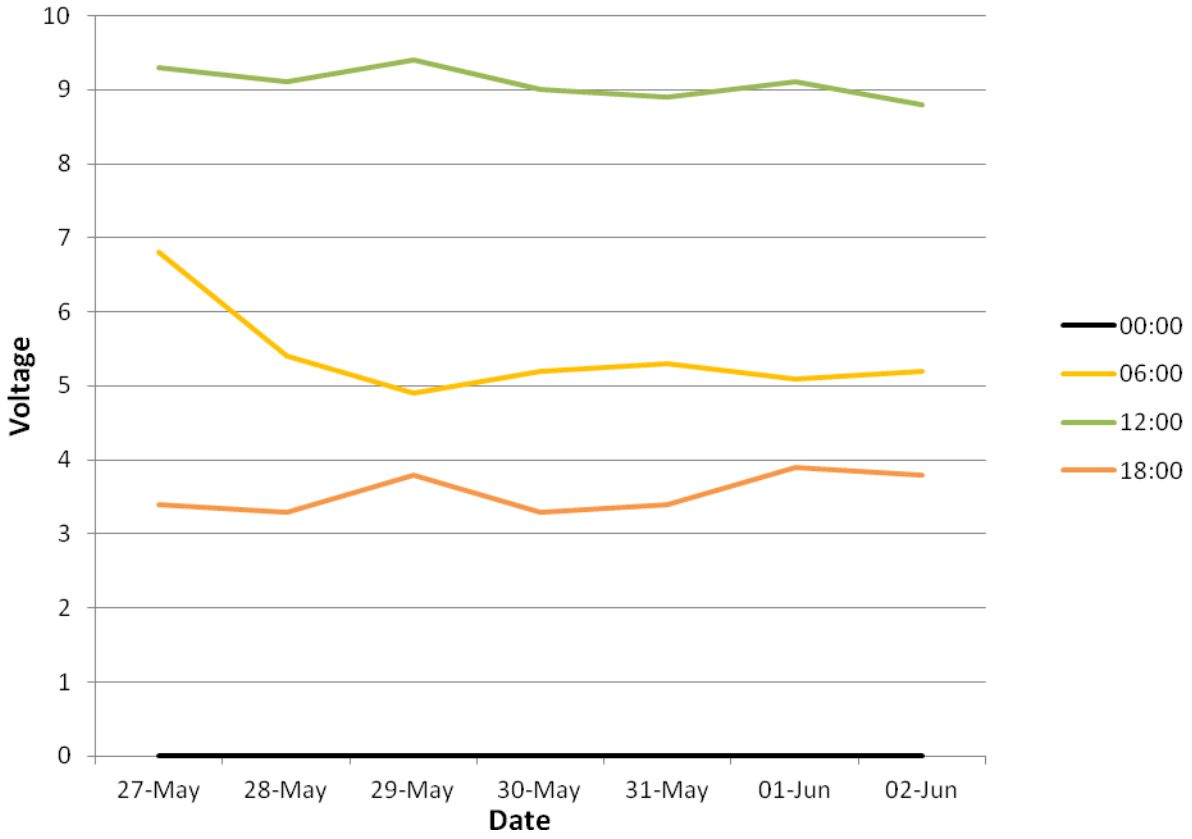
In Figure: Flowchart of the Energy Theft Detection System



In Figure: Block diagram of the system

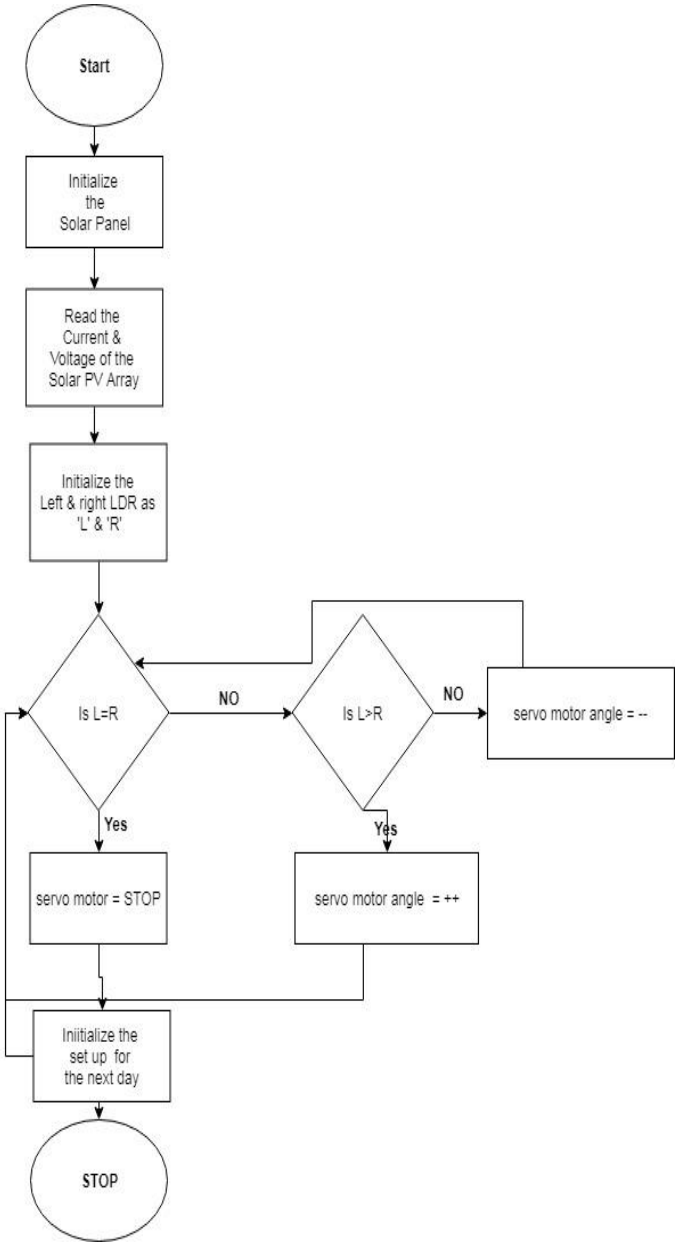
DATE / TIME	27-May	28-May	29-May	30-May	31-May	01-Jun	02-Jun
00:00	0	0	0	0	0	0	0
06:00	6.8	5.4	4.9	5.2	5.3	5.1	5.2
12:00	9.3	9.1	9.4	9	8.9	9.1	8.8
18:00	3.4	3.3	3.8	3.3	3.4	3.9	3.8

In Table: Voltage readings of the solar panels used having ratings as output=3W, Voltage at max.Output=10V, Current at max.Output=1.24A.



In Figure: Graph plotted against Date versus Time for the obtained voltages from solar panel.

Furthermore, to generate renewable energy, the system is connected to a solar PV array. This PV array is driven to produce maximum power that can be generated with the help of solar tracking. This technique is used to find out the optimum operating point ie.the point where the solar PV panel will produce maximum power from the solar input given to it. This technique can be used with help of multiple algorithms like incremental conductance, grey wolf etc. The Solar panel tracks the position of the sun & produces the output in the form of electrical energy. The solar PV array is connected to a solar charger which is connected to a battery bank. The battery bank can provide energy to the whole system during the periods of darkness or when sunlight is low.



In Figure: Flowchart of the Solar Tracker

VII. CONCLUSION

The whole farming system was successfully implemented. The irrigation system was working satisfactorily & the user was able to operate the water irrigation pump as per his requirement.

The energy theft detection device was working as per the requirements & detected the energy theft & was able to sound the buzzer when the energy theft was detected. The energy theft detection device was also able to show the consumer or the user his overall power consumption as well the voltage supplied to the system, current in the system & the energy in SI units.

The solar tracking mechanism was working as per the system requirements & we were able to find out the maximum power point of the solar PV panel with the help of this mechanism. The point which corresponded to the maximum power was detected & the solar panel was operated on that position.

Thus, the whole system was working according to our expectations.

REFERENCES

[1] Pei-Wen Li , Peter Kane , Matthew Mokler " Modeling of solar tracking for giant Fresnel lens solar stoves" in elsevier scincedirect, Available online 16 August 2013.

[2] Ibrahim Sefa, Mehmet Demirtas, Ilhami Çolak "Application of one-axis sun tracking system" in Energy Conversionand Management elsevier scincedirect Available online 26 July 2009.

[3] Ali H. ALmukhtar "Design of Phase Compensation for Solar Panel Systems for Tracking Sun" in elsevier scincedirect TerraGreen 13 International Conference 2013 - Advancements in Renewable Energy and Clean Environment.

X. N. Zheng, “Study on Sun-Tracking Methods and Application,” Energy Technology, vol. 24, pp. 149-151, 2003. N. Mohammad, T. Karim, “Design and Implementation of Hybrid Automatic Solar-Tracking System,” Solar Energy Engineering, vol. 135, pp. 11-1

AUTHORS

First Author – Neha Noren Parshad, Electrical and Electronics, Northern India Engineering College, Delhi,India, nehaparshad2015@gmail.com
Second Author – Alwin Philipose, Electrical and Electronics, Northern India Engineering College, Delhi,India, philipose.alwin@gmail.com
Third Author – Shakti Chitnis, Electrical and Electronics, Northern India Engineering College, Delhi,India, Chitnis3@gmail.com
Fourth Author – Aparna Sharma, Electrical and Electronics, Northern India Engineering College, Delhi,India, aparna.sharma132@gmail.com
Fifth Author – Kritika Pachouri, Depatment:Electrical and Electronics, Northern India Engineering College, Delhi,India kritika.k440@gmail.com