

An Intelligent Solar Based Farm Monitoring using Cloud Based Online Access Control Systems



S S P M Sharma B, Anuj Kumar, Brijesh Kumar Meena

Abstract: *Agronomy is the cornerstone of nation encountering untimely obstacles in the present scenario. Transducer nexus and their deployment in Farm Monitoring is the major utility for the nation. As agriculture is utmost provenance of nourishment, as there is a necessity to lessen the tariff and human interventions by enlarging productivity. This paper deals with advancement of IoT which lessens the endeavors of human by machine to machine interactions (corroborate through cloud based networks). The consumption of solar power by various devices can be monitored with the help of microcontroller interfaced to sensors and transmit the data through Wi-Fi devices which is stored in cloud based system. Process of irrigation is carried out in various methods using transducers which results in the distinguishing of soil moisture and temperature along with humidity conditions and it also authorizes the user to supervise the gadgets from remote locations using cloud computing systems provided with procured login credentials allocates access to know the status of all the installations through Laptop/PC/Mobile/Tablet.[1]*

Keywords: *IoT, Solar Panel, Arduino Microcontroller, Wi-Fi Module, Temperature/Humidity/Moisture Transducers.*

I. INTRODUCTION

This In the modern era essential need is agriculture. Tillage are entailed with scientific panacea to intensify the fecundity, while the habitat intuition lessens by dwindle utilization of agro-chemicals and enlarge the utility of inherent features of conducive controlling enactments. Supremacy of this is to lessen production cost. The expeditious scientific commencement and progression in the present day acutely authorizes the fruition of these intentions by eradicating numerous hindrances for validation, incorporating engagement by farmer itself. In conventional tillage requisition, cultivation is superintended without the utility of voguish scientific knowledge. A significant aggregate of

pedagogy is needed for appropriate efficacy. With the utilization of conventional scientific knowledge in tillage, decisiveness like seeding, yielding, deluging entails the utility of present weather fetters and momentous features to regulate flawless activity to accomplish favorable yielding. Consumption of energy is expanding regularly at the same time resources for energy is lessened equidistantly. The utility of power is extremely emerging by creating a space for energy efficient technologies like renewable sources. In juxtaposition intelligent systems utilizes scientific terms i.e. transducers, actuators, Wi-Fi, Automation, and data examining programs to utmost the aggregate the live ware that agriculturist appeal and enlarges quantity of superintendence stated to harvest when desired.[1]

Solitary propitious arrangement towards accomplishing farm monitoring is using Internet of Things (IoT) gadgets for the observing of vegetation and domesticated animals. IoT gadgets are little, low power implanted hardware which have the capacity to transmit information over a system. This is regularly alluded to as an IoT organize, where gadgets speak with one another to cooperate in accomplishing a shared objective. For example, with an IoT-based cultivating network, sensors can be sent to gather ecological data on the dirt dampness. The deliberate data would then be able to be used in a computerized water system framework to properly water plants, forestalling over and under watering. An IoT network could likewise give the excess comfort of giving agronomist the capacity to screen field conditions remotely and continuously. Observing domesticated animals can guarantee that the creatures are by and large properly encouraged and thought about, which is similarly as significant as checking vegetation in a field. By utilizing IoT gadgets, it can enormously diminish work expenses and increment the prosperity of the creatures. Utilizing IoT gadgets, information with respect to the area and wellbeing of the domesticated animals can be gotten.[2]

One more trust worthy approach that helps in solving many of the problems that farmers face in today's society comes from the use of Wireless Sensor Networks (WSN). By using transducers to congregate environmental information from areas in a field, a farmer can then focus on taking care of those areas that require special attention, improving overall efficacy. Most common advantage that WSN enacted in agricultural monitoring is that transducer nodes can be customized to the crop being monitored. While one crop might be heavily reliant on proper soil moisture, another might be greatly susceptible to the concentration of hydrogen ion (pH) levels in the soil.

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Another utility of WSN is the scalability. Since transducer nodes can be easily added or removed from a system, overall costs can often be reduced as the monitoring needs can vary from season to season.[3]

This paper deals with intelligent solar based farm monitoring systems incorporated with wireless internet of things devices. In an endeavour to abet agrarian fabrication, the proposed system was fit for estimating the soil conditions, temperature, moisture, and charge left on the battery. Transducer hubs were configured with solar powered boards that were utilized to draw solar energy and restore the battery. Appropriate to govern how effectual vitality garnering can be in a network, juxtaposition is proffered betwixt two homogeneous transducer junctions, where one has potential to produce solar power to levy its battery. The predominant bequests of this work are as accompanied: [3]

- A network incorporated with framework hubs was depicted for intelligent farm monitoring applications with energy congregating potentiality.
- Agronomist is able to effortlessly examine the habitat surroundings expeditiously by the assistance of web applications.
- An examination utilizing diverse battery power supplies is performed.

II. RELATED WORK

To erect a contemporary agriculture with pristine and emanate conception is utilized in escalating the production of harvest by enlisting the upgraded scientific knowledge to abet in conventional agriscience executions. Postulations like Smart Agriculture, Internet of Things (IoT), and Transducers are complete modus operandi which is utilized for conventional harvesting to assist in yielding crops, intensifying efficacy and restrain the tariff. In literature, a numeral of interconnecting networks utilized transducers have been recommended and examined in supervising plant life and yielding for smart applications. While few delineation have concentrated on progressing inexpensive operating panacea. Alternative approach is to cornerstone on deploying wireless personal area networks to engender Zigbee based network competent of deducting overall energy consumption, ameliorating the network span, and enhancing the production. Information accession, physical surroundings supervision and exactness in farming are able to perform by the employability of numerous transducers systems in agriculture.

While contemplating numerous circumstances for agriculture such as power and sunshine, water is solitary paramount prerequisite, so preserving water amenities and regulating it for agriculture is extremely predominant. Preservation is feasible by employing a cloud based online access control systems and monitoring farm by utilizing IoT. Automation is the utmost scientific terminology progressing in every field including agriculture. [4]

III. DEVELOPMENT OF SYSTEM

A. Hardware Components

The hardware components that were engaged in the modification of the delineate paradigm. The components engaged are solar panel, microcontroller, numerous

transducers, Wi-Fi, Ethernet board, electrical devices with 12v supply. [3]

B. Solar Installations

The most extortionate module to examine and stratagem is solar panel. Therefore recognizing inexpensive modules with a pre-eminent potential rating is acting as pivotal component in terms of rendition and tariff cogitation wise. The ingress of enactment of communion is made with speed and efficacy by the assistance of employability of IoT in crispy and effortless. And the predominant factor that bangs in everybody mind is IoT effective to accumulate all those incorporated commodities since the usefulness of solar energy came into extant and as a human being we credence that the energy accessible for future is solar energy. [4]



Figure: Solar panel

Solar panel is essentially existed with ancillary portion of solar Photovoltaic Cells for effective use of energy and reusing. In every part of this operation there may be a probability of fallacy contingency in solar Photovoltaic Cells which drifts the entire module incompetent so acknowledging those cells to perform in persistent state the monitoring process is executed. [6]

To give vitality collecting capacities to the module, a Star Solar D165X165 monocrystalline solar panel was used. Just 170 x 170 x 2 mm, the sunlight based board was equipped for giving a out-turn of 6.0V at a pinnacle of 3.65W. The compact size makes it reasonable for arrangement in a field where it would have negligible impedance to any of the developing plants encompassing it.

C. Microcontroller

The Arduino microcontroller is elited for this significance as it proclaim abutment frill for Ethernet which will aid in accomplish IoT segment of the system. The microcontroller subsists of definite files for cloud based system which will endeavour to superintend the transducers employed in the system through internet. [3]

Performance tariff and potential deplete by this is extremely less and without regulating the rendition it will try to control both USB and Ethernet. [3]

The microcontroller will be explicable to operate the input and output to intact solar system. This errand subsume scrutiny transducer efficacy distinguish system interpretation and anomaly along with communicate information wirelessly.

The microcontroller should comprise of less potential; lessen form factor and it should be prominently accommodating adequate programming expanse. A vigorous programming language and programming software (IDE) assisted with the microcontroller are proffered. [5]

D. Transducers

Transducers are the appliance which authorizes a physical quantity to interface with the gadgets so that it can be explicate by the operand or machine. The execution of transducers in this project is to attain appropriate functionality of the system. The unpredictability in variables like potency of light, temperature, sky conditions and other environmental aspect are going to have unswerving effect on the flaunt rendition of solar panel & farm monitoring. These transducers are used to detect the temperature and humidity and moisture of system. [4]

1. Capacitive Soil Moisture Transducer computes soil moisture proportions by capacitive transducers preferably when compared with resistive transducers. It is trumped-up of corrosion impenetrable matter which consigns a magnificent service life. This module incorporates a locally available voltage controller which gives it a working voltage scope of 3.3 ~ 5.5V. It is ideal for low-voltage MCUs, both 3.3V, and 5V. For similarity with an open source cloud platform, it will require an ADC converter.[6]
2. The DHT22 is a rudimentary, inexpensive digital temperature and humidity transducer. It employs a capacitive humidity transducer and a thermistor to compute the circumjacent air, and distinct out a digital signal on the data pin (necessity of analog pin is not essential). It's adequately rudimentary to use, but needed cautious synchronization to capture data. These transducers were preferred as large extent of crops will provide the significant yield when the temperature and humidity are inside a perfect gamut. These computations become predominant in greenhouses as exterior conditions can considerably impact those inside the greenhouse. The potentiality to restraint the circumstances can considerably aid in the evolution of the crops themselves as essential necessity at specific temperature and humidity stages throughout the numerous levels of development. [6]

E. W5100 Ethernet Shield (Web Server)

W5100 is engaged at diminutive potentials, phenomenally energy prudence Ethernet shield which can be proficient at 5V. W5100 is an open source and programming is tender with the aid of Arduino Uno. W5100 impart a system (IP) which is adept for both TCP and UDP, and it furthermore performed for Php, Html, etc. and constituted as a abet for variegate Application Program Interfaces. By deploying W5100 Ethernet shield we can expeditiously signify regional servers which can be engaged from a distance by readdressing the uniform IP of the router. [4]

F. Microcontroller online compiler

The microcontroller advancement unit facilitates the controller with C/C++ stage which additionally gives an application programming interface procedures to microcontroller. [6]

IV. PROPOSED IMPLEMENTATION

The proposed system is practically composed of solar panel, battery, the control circuit, Wi-Fi Module, Microcontroller and web servers (PhP).

The regulated network is subsumed with Arduino Microcontroller and temperature/humidity/moisture transducer. [1]

In the proposed system the gadgets can uniformly scrutinize the solar power tracking and controlling the system will aid in deducting the profligate of energy. The proposed system is adept of authenticate diverse circumstances of utensil which are having the intelligibility of heterogeneous modules which are interlinked with solar panel will be treated as IoT operated gadgets. [2]

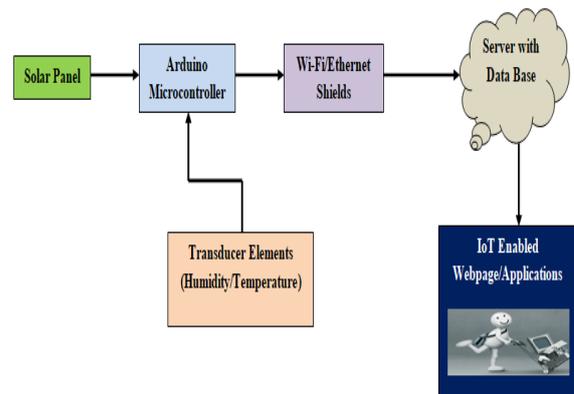


Fig 2: Block Diagram Representation of Proposed System

The proposed system is intended to reckon the attainment and abet lucrative soil transducers to erect an expropriate farm monitoring network. The network comprises of multiple subsystems known as master and slave, open source software of cloud computing Raspberry-pi is the master junction and wireless transducer module is represented as a slave. They are congregate with an observation transducer to distinguish the dampness in the soil. These transducers are amalgamated with the Raspberry pi. Continuous physical quantities signals are acquired from the transducers are consigned to the ADC (analog to digital converter) furthermore information was sent to open source operand (Raspberry Pi). Internet of Things embed web based execution is elaborated for supervise and regulating the gadgets remotely operated from any location at any time. The data accumulated from transducers are stockpiled in the database or server. [7]

The suggested system accommodates user with intensifying quality and expanse of their homestead crops by observing circumscribe temperature, humidity and loam moisture serene and additionally acknowledges inferno if supervened in a farm by any form. Each chore divulged is executed without human intercession. The efficacy of the module is maintained by the utilization transducer system along with Internet of Things. Intelligent farm monitoring system consists of transducer module, open source cloud platform and IoT system modules.

Figure 2 elucidates the network erection that delineates the farm monitoring module for agronomy. [8]

V. RESULTS

Experimental Setup

Homestead observing framework for farm application comprises of remote detecting gadgets that are set in rural territories to accumulate information, for example, dampness, temperature, moistness and fire. The accumulated data are imparted to open source end of cloud computing (Raspberry pi) by means of Wi-Fi utilizing Master Slave correspondence model. Raspberry pi, which goes about as an ace hub, controls its gadgets or procedure known as slaves. [9]

This procedure comprises of capacities like putting away information, gathering information from slaves, registering and coordination of data. The raspberry pi can set up a Wi-Fi system and run the correspondence model that is utilized to gather information from sensors to raspberry pi and from pi to the server. The client coalition that is the web application dependent on IoT stage enables clients to keep up rural information in genuine time. [9]

The essential favored outlook of the proposed structure is that the expense of the arrangement dynamically is low as raspberry-pi and other modernized sensors with web of things are used. The structure can without quite a bit of a stretch end the enveloping condition. [8]

The utilization of the proposed framework come in the regions of agrarian fields, horticultural research stations, development zones and nursery plants. Fig. 2. Speaks to the design portrayal of the ranch observing framework. The framework arrangement demonstrates how the sensors can be sent in the farming field by taking a grower for instance. The arrangement can be valuable in any sort of the farming field and can show signs of improvement yield.[8]

The whole system setup was established as it consists of microcontrollers interfaced to sensors and electrical devices through which all appliances can be controlled. [6]

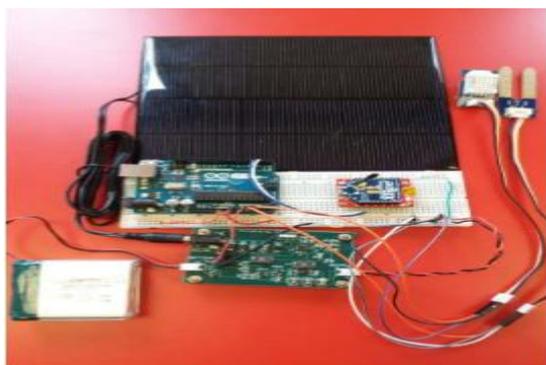


Figure 3: System Setup

The created framework can be tried with the assistance of detecting units and introducing Ethernet/Wi-Fi based systems at few spots. By interconnecting Ethernet/Wi-Fi to the Internet Protocol with the assistance of IoT applications the coordinated framework is ceaselessly utilized and produced constant portrayal via mechanization data. [9]

In this way, the solar arrangement of the Farm checking activities has been reflected as IoT for better far off use and controlling through a web site.

The estimations related through sunlight based warming gadgets can be spoken to with the assistance of detecting unit progressively activity by IoT application. [10]

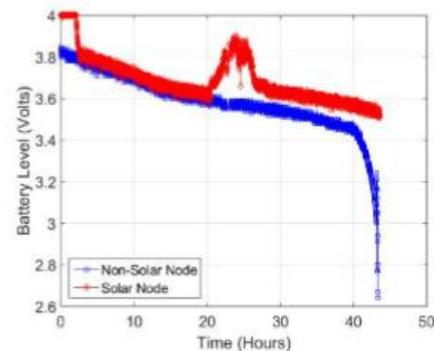


Figure 4: Reduction in voltage consumption for solar device

The another method for utilizing detecting unit mix through IoT application can be any electric apparatuses like charging units, fridges, forced air systems and so forth through IoT application. Contingent upon the utility through mechanization these gadgets are controlled through tax or IoT based site. Once there is a high increment in the cost of duty then the undesirable electrical gadgets can be turned off consequently with the assistance of IoT site. [10]

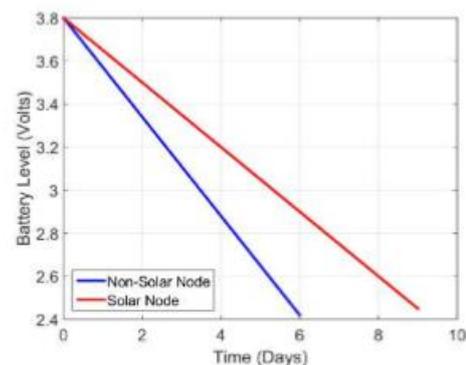


Figure 5: Consumption of power for transducers

To quantify the surrounding readings in the homestead like temperature. Contingent on the states of the condition the detecting components which are utilized are going to make the states of gadget on/off which is worked remotely and successfully.

The web applications are portray and created utilizing PHP capacities. These capacities give the continuous showcase of the sensor information on the site pages.[11]



Figure 6: Information of data on web

Controlling gadgets dependent on server

By and large microcontroller is communicated with Ethernet to make a particular IP and page is intended for which IP is created in the URL at that point page will execute and customer can control any electric gadgets by making on and off.[4]



Figure 7: Login Page

S.No	Status of solar Panel	Condition	Soil Moisture Percentage	Temperature	Humidity	Date & time
1	Charging	Load On	0.28%	10.0°C	69%	25/04/19 & 15:05:18
2	Charging	Load On	0.394%	17.5°C	67%	05/05/19 & 13:23:22
3	Charging	Load On	0.7%	17.0°C	60%	23/05/19 & 10:40:36
4	Charging	Load On	0.5%	15.6°C	61%	18/06/19 & 11:35:48
5	Charging	Load On	0.25%	15.3°C	57%	25/07/19 & 09:25:58
6	Charging	Load On	0.46%	19.6°C	57%	03/08/19 & 11:14:00
7	Charging	Load On	0.29%	22.6°C	48%	22/08/19 & 12:35:28

Figure 8: Profile Customization

VI. CONCLUSION & FUTURE SCOPE

With the progressions in innovation, it is foreseen that the availability of web is all over the place and online at unsurpassed. Sensor empowered gadgets are associated effectively and related data can be available around the world.[1]

With the attribute of versatility, adaptation to non-critical failure and viable power utilization and IoT have facilitate the computational capacity to internetwork heterogeneous savvy gadgets effectively and encourage accessibility of information anyplace.[3]

The proposed framework is the typical utilization of vitality can be lessened. By charging the proposed computerized framework on a normal all out vitality devoured by gadgets can be decreased by executing cloud based checking and controlling of framework through IoT. [4]

This brilliant homestead observing network is a significant system as it underpins rancher by furnishing robotized water system framework with programmed detecting methods. Rancher can get the data about the horticultural field like moistness, temperature and dampness substance of the sand by the web application created. Down to earth uses of sensors assembling instruments to arrive at the objective of the ranch

observing framework. The fast mechanical methodology and development lately incredibly empowers the accomplishment of these objectives by dispensing with numerous obstacles for the sanctioning, including reservations by agriculturist themselves. [7]

The possibility of the proposed framework is to create a minimal effort arrangement and adaptable association components for coordinating Internet of things with remote checking frameworks.[8]

A gadget working at remote area of the world can have the option to manage from other area of the world. In future sundry of gadgets can have the option to impart among them utilizing same innovation. [9]

It is foreseen that IoT based applications are advancing towards improvement of brilliant worked matrices and urban communities by 2030 and as referenced it has security insufficiency which must be given greater need. [10]

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