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Research Paper

IOT based self-tracking solar powered smart irrigation system

Abdul Raheman [1, 3] *, M.Kameswara Rao [1], B. Vamsi Reddy [1], T. Ravi Kumar [2]

[1] B. Tech Final Year, Dept. of ECM, Koneru Lakshmaiah Education Foundation, Guntur Dist., Andhra Pradesh, India
[2] Associate Professor, Dept. of ECM Koneru Lakshmaiah Education Foundation, Guntur Dist., Andhra Pradesh, India
[3] Associate Professor, Dept. of CSE Koneru Lakshmaiah Education Foundation, Guntur Dist., Andhra Pradesh, India
**Corresponding author E-mail: raheman104@gmail.com*

Abstract

This Article is based on the Agriculture where it is the backbone of our country. This paper mainly deals with monitoring the conditions like soil, water in Agriculture. There are several factors that effects the Agriculture that may be a lack of water facility, and utilization of proper pesticides in proper time, and sometimes due to the low soil moisture content available in the soil. In this paper it discusses the soil and water conditions and how can we supply the proper water with respected to time as well as without the human intervention. For this we need some hardware's and software's integrated together for a final output. When going to do this project we need a lot of technologies that must be integrated together such as sensor networks, Cloud computing, big data, and finally some Interfaces to control the things. Here the farmer can supply the water in time to time so it needs a power supply to run the motor for that it is better to take a solar energy because it is a Renewable energy and could supply the energy throughout the day time. And there are some few existing problems that can be analysed. Finally this paper forecasts the monitoring of soil, water conditions in the Agriculture.

Keywords: *ATMega8; Sensors; Motor and Soil.*

1. Introduction

Nowadays, in case of business parts of farmers many offerings of nearby nourishment grains are ending up plainly more famous on both sides of the merchants and purchasers. Also Consumers are enthusiastically required to know the solid substance in natural nourishments and encounters the wellsprings of their sustenance. Agriculturists have risen as an imperative piece of the informal organization. Steve Ingham, the chairman of the division of nourishment safety, on the Department of Agribusiness, Trade and Consumer Protection (DATCP), exposed a critical records that that modern dwelling house markets are not relics of extra truthful beyond agriculture. Lacking in refrigeration and the specimens which changed into eaten by the purchasers are the two essential problems uncovered via Ingham. Sellers will certainly discover a extra noteworthy hassle to safeguard the risky sustenance grains and nourishments at refrigeration temperature. The reason for that energy is a noteworthy hassle. These articulations had been given by Ingham. Additionally, the sustenance and test dealing with matters a greater amount of buyers who eat prior and then afterward they were building up the selection to purchase.

Secured Agriculture is a cutting edge era method going for high go back and quality. It offers right improvement situation via building techniques under simulated workplaces assurance conditions. A definitive objective of Protected Agriculture is making farming technology perfect, free from characteristic ecological factors and carrying out program talented introduction. It is a joined end result of science, circumstance, designing and IT. The road to Protected Agriculture is the development of the workplace living space's managed and checking system. Due to decline of labour in agribusiness area, we've planned a project which doesn't need a person to monitor the agricultural field all the time. This device is particularly connected to the patron mobile device making use of IoT concept. IoT is a situation in which people are supplied with one of a type identifiers and the capacity to change information over a device without obliging human-to-human or human-to-computer collaboration.

The IoT (Internet of Things) based cultivating union development is an development to make a excessive regard, for example, change of creation capability, the pleasant augmentation of country things in the whole system of provincial technology. Likewise, executing precision cultivating, which is some other alternative to the future agriculture, via the joining development presents preference of free market movement, consistent business enterprise, and quality preservation inside the midst of the entire life cycle of cultivating items. Techniques for harvest awaiting have ended up being dynamically complicated. In particular subtle quantifiable frameworks in cultivation are presently getting used to assume information from past statistics and to wander discern estimations of money related factors. To a steeply-priced degree, those advances in the research of gather assessing have been increased viable by ground in IT improvement, but solitary actual systems don't give complete circle future scenario. Thusly, it is essential to dismember evaluating checking crop situations with proper statistics that has been recorded. It's far normal that from IoT-based decision definitely robust device, this statistics on the true case of yield may be obtained. The reason behind this audit is to enhance the green discern assisting records device, so that continual gauge will be feasible.

The IoT-based farming era system incorporates of three sections: connection research, genuine forecast, and IoT advantage. This framework is deliberate a farming preference emotionally supportive community to foresee edit improvement via checking intermittently utilizing the IoT sensor innovation.

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2. Existing work

M. Kranthi Kumar and K. Srinivasa Ravi [ijst, vol 9(17)] discussed about the automation to supply water in the farm fields using concepts of IoT and the Wi-Fi technology. Sensors are placed in the field and the data from the sensors is sent to the user. These sensors record the values of the moisture present in the soil and the temperature and these values are sent to the main station. The main aim of this main station is to gather the data from the field station and store these values in internet via Wi-Fi technology.

Ashutosh Gupta, [ijst, vol 9 (47)] mainly focused on the controlling of irrigation according to the need. Sensors such as Temperature sensors, Moisture sensors, pH sensors have been used. These sensors are used to tell the user about the condition of the soil. User can control the system according based on these conditions. This device is also automated, it means that we will specify some values of moisture and when the moisture level goes below the given values the system will automatically switch on the pump and the pump will stop until the required moisture level is obtained. This system is powered by solar panels.

V. Vijay Hari Ram, [IEEE TIAR 2015] said due to lack of exact information and communication shall lead to drought condition or less yielding. This paper deals how to overcome these problems. Here IoT (Internet of Things) platform is used to monitor the agricultural system in a smart way. Main things or devices that are used are GSM modem, Soil Hygrometer, Water level sensor, and Solar panels .He also used a Suction hose is to remove the excess water in the soil. GSM modem is used here to communicate with the user via mobile phone. Soil hygrometer is used to detect soil moisture level.

M.K.Gayatri [IEEE TIAR 2015] uses Cloud computing. Combination of IoT (Internet of Things) and Cloud computing is used that helps in fast development of agriculture and helps to efficiently solve the issues related to farmer in a smart manner.

3. Proposed work

In the proposed system we will be using the hardware and software combined together that is it is an embedded system. The hardware system will be used or monitored using the software. An android app is developed using which we can control and monitor the motor.

The various components that are used in this system are :

3.1. Soil hygrometer

The below figure shows a Soil Hygrometer Module. The soil hygrometer measures the water level of the soil. The two probes act as the variable resistors and when there is more water content in the soil then there will be good conductivity and that results in low resistance value. The analog readings are dependent on the input Vcc. The recommended power for the Soil Hygrometer is 3.3V - 5V. Different soils has different Capability to hold water. Accordingly we need to preset the values. These values are stored in the cloud for future use.

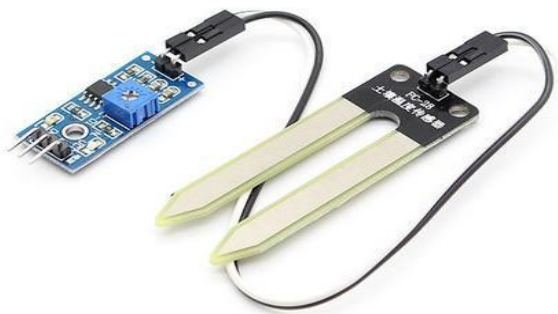


Fig. 1: Soil Hygrometer.

3.2. PH sensors

Soil also can be acidic and basic in nature. Soils that have pH value above 7 are mostly basic or sweet in nature. Soils with pH value below 7 are acidic or sour in nature. The pH value of the soil determines that which crops it can grow and which nutrients are available in the soil because different crops need different nutrients for their nourishment. The primary nutrients that a plant needs for a healthy growth are Nitrogen, Phosphorus and Potassium. There are also other nutrients such as Iron, Manganese that are also useful to plants but these nutrients are in very less amount.

3.3. GSM module



Fig. 2: GSM module.

GSM stands for Global System for Mobile Communications. It is used to create a communication between a mobile device and a GSM system. It is developed by the European Telecommunications Standards Institute (ETSI). GSM module or GPRS modules are similar to modems (Modulator-Demodulator) but a GSM or GPRS modem is external equipment whereas GSM or GPRS module can be integrated inside the equipment. This requires a SIM card (Subscriber Identity Module) same as like a mobile needs for activating the communication with the network. IMEI (International Mobile Equipment Identity) number like mobile phones are given for their identification. A GSM modem can receive, send or can also delete SMS messages in a SIM which is used in our proposed system.

3.4. Raspberry pi or ESP8266



Fig. 3: Raspberry Pi.

A Raspberry Pi is a mini computer that can be used with a computer monitor or a TV. It has some ports that help in connecting with the standard keyboard and a mouse. It is capable to perform almost all the operations that can be performed on a Computer such as browsing, playing games, making spread sheets, and also playing high definition videos. There are many Raspberry Pi models which has different features such as memory size and different number of ports and improved power consumption.

ESP8266 is a Wi-Fi microchip. This allows the microcontrollers to connect to the Wi-Fi network. Using this module we will connect our system to the network and make it and IoT platform.

3.5. Zigbee module



Fig. 4: Zigbee module.

It is an IEEE 802.1514 based specification used for high level communication used for creating a Personal Area Network (PAN). This Zigbee module uses low power digital radios. It is mostly used in home automation scenario and also for areas where low power and low bandwidth are needed that are associated for small scale projects that needs a wireless connection. The data rate that a Zigbee can have is 250 Kbps which is very useful for the data transmission from the sensors.

3.6. Solar panels

Solar panels are the modules that absorb sunlight as source of energy and generates electricity or heat. Solar panels are made up of Photovoltaic cells (PV cells). Solar panels are cheap and are most widely used in the present generation. We will be using solar panels and these solar panels are connected to a rechargeable battery. The electricity generated by the solar panels is stored in the rechargeable battery for future use. As solar panels are renewable energy resources it is cheap for maintenance for longer period. Solar panels vary upon the size and the amount of electricity they generate.

Self-Tracking System

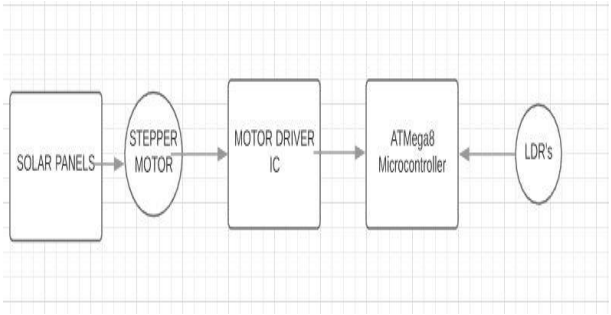


Fig. 5: Self-Tracking Block Diagram.

We will be using the following components for self-tracking solar panels to the sun position:

- LDR's
- Solar Panels
- Stepper motor
- ATMEGA8 Microcontroller
- Motor driver IC

LDR's (Light Dependent Resistors) is a component that varies its resistance when the light falls on it. LDR's are placed the either sides of the solar panels. These LDR's generate less impedance when exposed to light. The stepper motor is connected to the panels so that the panels rotate in the direction of the sun. Panels are arranged in such a way that when the light falls on the LDR's and that is compared and on which side the light intensity is high .i.e., low resistance the panels are rotated using the stepper motor at certain angle. If the light intensity falling on the right LDR is high then, the panels rotate in the direction of right and if the light intensity falling on the other LDR is high then, the panels turn on the other side and on the midday time the sun is overhead then the light intensity falling on the LDR's is equal and there will be no change in direction of solar panels. Stepper motor will help in rotating the solar panel in a step by step angle and to drive this stepper motor we require a driver IC. The main use of Driver IC is to amplify input voltage and thus protects the microcontroller from back EMF generated by the motor. Mostly motors will generate back EMF which may lead to damaging of the microcontroller. We will be using L293D IC for this system. L293D IC consists of 16 pins which comprises of output pins which are connected to stepper motor and the pins used for input are connected to the microcontroller.

ATMEGA8 Microcontroller

ATMEGA8 microcontroller comes under the family of AVR microcontroller. It is composed of RISC architecture. It is 8 bit controller. This microcontroller has 8KB of self-programming flash memory, 512-Bytes of SRAM, 256-Bytes of EEPROM, and 12-bit voltage A/D converter. It is resistant from over-current, high-current and short-circuit protection. It is specialised with various peripheral features such as two 8-bit timers, one 16 timer, 6 channel ADC with 10-bit resolution, programmable USART.

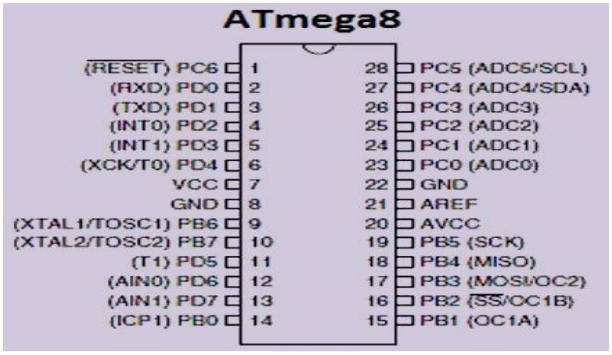


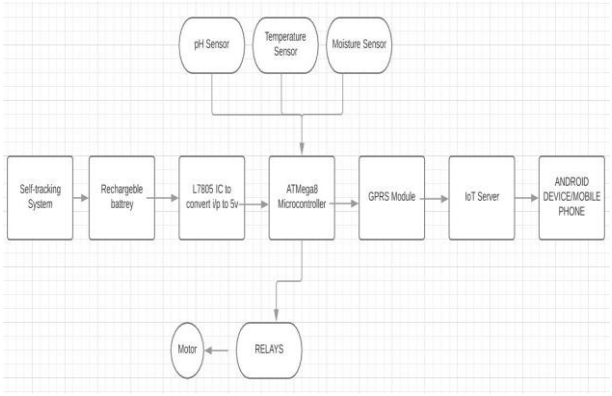
Fig. 6: ATMega8 Pin Diagram.

4. Methodology

The system is powered using the Self-tracking Solar Panels. The solar panels convert the energy from the sunlight into the electric energy. This converted energy is stored in the rechargeable battery through which our circuit is powered. The rechargeable battery used in this system is of 12V 3A. The microcontroller uses 5V power input but the input that is given may be higher than 5V which may damage the microcontroller. For this we will be using 7805 Voltage regulator IC which can take input from 7V to 25V and the output from that IC is only 5V which is enough and safe for the microcontroller. During the power flow to the IC there may be power hikes which also may damage the IC so we will be using compensating capacitor. This compensating capacitor will prevent the sudden hikes in the power supply to the microcontroller. Sensors are arranged at the root of crops or plants. These sensors detect the changes such as temperature or low moisture content at the root nodes of the plant or the crops the sensor will sense and send signal to the gateway. Again the ATmega8 controller is used in which the Pin1 will be used to reset and using this we will reset the system every time we turn it on. It the system is not reset then the code will be executed form the previous state where it was stopped at last time of execution and this may result in the wrong functioning of the system.

This system is paired with the user using the concepts of IoT (Internet of Things). For connecting the system to the internet we will be using GPRS module. We will be providing a SIM with internet facility and this will connect the system to the IoT server. By this we will be remotely monitoring our system using some android application. This helps the user to access remotely the system from anywhere. This GPRS module is connected to the 2 and 3 pins of the ATmega8 microcontroller. The 23 pin of the ATmega8 microcontroller is connected to the soil moisture sensor and the data is received from it. The motor pump is connected to pin 14 and used to trigger the soil moisture levels.

5. Block Diagram



IOT (Internet of Things)
IoT plays a major role in communication between the user and the system. This helps in acknowledging the user regarding the present status of the field. The concept of IoT is used to control the data from the server, from where we can see the data from the sensors.

6. Conclusion

As we know that irrigation is very important for our livelihood. There are many places where it is difficult for the farmer to check the crops and monitor them all the time. By using this system we can continuously monitor the soil conditions and the farmer need not always go to the field for checking the water levels. This system also helps in reducing the wastage of water which is very important as the water is getting depleted day by day. As the generation is being changed in day to day life new technologies are emerging in which there are very less technologies used for irrigation purpose. We can continuously monitor the soil conditions using some sensors. This system reduces the human intervention on the agricultural field. As the system can be easily controlled by the user from any place without being physically, attending the field in person. By using soil moisture sensor we will be checking the water levels and by using pH sensor we will be checking whether the water present or being supplied to the field is essential for that crop being grown and if it is not fit for that type of crop the motor can be stopped. As we are using the renewable energy resources this helps in reducing of electricity. This system can also be used in garden and parks.

References

[1] Automation of Irrigation System based on Wi-Fi Technology and IOT M. Kranthi Kumar and K. Srinivasa Ravi (India) Published in Indian Journal of Science and Technology, Vol 9(17), DOI:10.17485/ijst/2016/v9i17/93048, May 2016.
[2] Android based Solar Powered Automatic Irrigation System -- Ashutosh Gupta,Varun Krishna, Saarthak Gupta and Jitesh Aggarwal (India) published in Indian Journal of Science and Technology, Vol 9(47), DOI:10.17485/ijst/2016/v9i47/101713, December 2016.
[3] Regulation of Water in Agriculture Field Using Internet Of Things - V. Vijay Hari Ram, H. Vishal , Dr. S. Dhanalaksh, P. Meenakshi Vidya (India),Conference 2015 IEEE International Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR 2015).
[4] Providing Smart Agricultural Solutions to Farmers for better yielding using IoT M.K.Gayatri, J.Jayasakthi, Dr.G.S.Anandha Mala (India),Coference 2015 IEEEInternational Conference on Technological Innovations in ICT for Agriculture and Rural Development (TIAR 2015).
[5] Sensor based Automated Irrigation System with IOT: A Technical Review", Karan Kansara et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 6 (6).
[6] Sanjay Kumawat, Sensor Based Automatic Irrigation System and Soil pH Detection using Image Processing, International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 04, April 2017.
[7] IoT based Smart Irrigation and Tank Monitoring System, International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) Vol. 4, Issue 9, September 2016.
[8] Intelligent IoT Based Automated Irrigation System, International Journal of Applied Engineering Research November (2017).