

Smart innovative system to predict the moisture of the soil, humidity and temperature using Arduino UNO and sensors

G. Mohana Prabha, T. Rumeena, J. Shanmuga Priya

Abstract:- The system is going to relay mostly on the data from the sensors namely moisture sensor, humidity sensor and temperature sensor. Previous systems that used a traditional methods like gravimetric method, using tensiometers, oven drying method. The oven drying method consists of taking a soil sample about 200 grams determining its weight, and drying the sample in an oven at a temperature of 100 to 110 centigrade for 1 day, then measuring the weight of the sample and determining the moisture loss by deducting the oven-dry weight from the moisture weight. So to overcome the Traditional System we have come up with the idea of using sensors will be accumulated in server that timely appends it to the already existing data. We will collect data over the period of time and design an intelligent algorithm that will alert the former with various notification like low moisture level, low mineral level, humidity and temperature. This will be boon for farmers to keep track of contents inside the soil and make prior arrangements on time to keep the soil alive and the plantations as well.

Keywords:- moisture sensor, humidity sensor, temperature sensor, oven drying method, tensiometers, gravimetric method

I. INTRODUCTION

Plants have had and still have a major role in the history of life on planet. They are responsible for existence of oxygen required for human beings survival on this earth. At the same time agriculture is also essential for human beings because it forms the basis for food safety. It helps human's grow the most ideal food cultivated plant and raise the right a living organism with accordance to natural factors. Farming involves a key role in our country's economy. Above 60% of the pastoral circle depend on farming as their proposition means of nourishment. The thing affecting farming process must be deliberate exhaustively to grab extreme outcome. The outstanding idea of farming is the irrigation system. Alternatively, the constitution of this idea may get sufficient results on agriculture. Forming progress should give water to

the earth reliably when it's required and close water circulate, when the sand has immerse water. Agricultural exports constitute 10% of the state's exports. So the farmer's and even the country's wealth will be ruined if there are no regular yields due to lack of understanding of the earth's nature, timely insufficiency of water. Thus the management should take steps for a greater and successful irrigation. In some countries, agriculture is considered as one of the major source of economic growth. The earning of many countries depends mostly on agricultural progress. Moreover, the continuous increase in the populace of a nation demands greater revolutions in nutrition production technology. The common factors affecting agricultural progresses should be deliberate exhaustively to grab extreme outcome. The outstanding idea to handle agriculture field's water status is the smart innovation system.

II. OBJECTIVES

The system rely mostly on the data from the sensors namely moisture sensor and humidity sensor. Previous systems that used a traditional methods like gravimetric method, using tensiometers, oven drying method. The oven drying method consists of taking a soil sample about 200 grams, determining its weight, and drying the sample in an oven at a temperature of 100 to 110 centigrade for 1 day, then measuring the weight of the sample and determining the moisture loss by subtracting the oven-dry weight from the moist weight. So to overcome the Traditional System we have come up with the idea of using sensors. The idea is to fix these both sensors together inside the soil, the data collected from the sensors will be accumulated in server that timely appends it to the already existing data. We will collect data over the period of time and design an intelligent algorithm that will alert the farmer with various notification like low moisture level, low mineral level, humidity and temperature. This will be a boon for the farmers to keep track of the contents inside the soil and make prior arrangements on time to keep the soil alive and the plantations as well. The major objectives are a) To help farmers to detect the moisture level in the farming fields and the humidity and temperature of the environment b) To keep track of the contents inside the soil and make prior arrangements on time to keep the soil alive and the plantations as well.

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III. LITERATURE REVIEW

**A. Title: Design of Temperature and Humidity Control System of Imitation Natural Biological Growth Authors : Xianyi Qian , Xiaoyan Jiang
Published in: IEEE, 08 January 2010**

The scheme is a greenhouse reproduction of humidity and temperature based on digital temperature sensor (DS18B20), that has the feature of emulation natural climate, the system can imitate organic growth in the natural climate downward the suitable state of humidity and temperature in inside the surroundings suitable with features – various organic development in surrounding. In this paper, majorly looks on, review of environment over of the organic development progress to determine the growth rules, and then to manage by personal computer in correspondence with the development rules, exterior building block of the knowledgeable temperature management system is modest, that has the features of great exactitude, elevated authenticity and with high-scale multi-object humidity and temperature calculation and manage. Based on the review in this paper, an unnatural surrounding generated in the latitude, and *Acanthopanax Senticosus* was refined in this paper. To equate with the unnatural *Acanthopanax Senticosus*' components, medicament cause and derived from nature *Acanthopanax Senticosus*', there is not any variance. It can be used for more difficult management of glasshouse humidity and temperature proportions, but it also can be used for humidity and temperature management at the simple fields like shipments, trains and etc.

**B. GSM based solar automatic irrigation system using moisture, temperature and humidity sensors Authors : Ateeq Ur Rehman, Rao Muhammad Asif, Rizwan Tariq and Ahmed Javed
Published in: IEEE , 18 December 2017**

The management being exceedingly depend on farming requirements ingenious and dependable functions of irrigation. The deficiency of guidance functions of irrigation should be corrected by self-operating progress. This survey gives the design of self-operating irrigation progress and the subsequent analysis assists with this concept. The progress of impulsive irrigation is finished by the cooperation of soil moisture sensors. In this scheme, moisture sensor, and also the humidity and temperature sensors are accustomed to produce the operation highly operable advancement. The expected scheme also has the characteristic of GSM that gives the scheme wireless. The power needed by the elements is furnished by solar panels from this discharge others from discontinuous energy supply due to the burden desquamation. The moisture is continually evaluated and whenever water level of sand gets reduced, the scheme conveys a signal to motors involving those to switch on. The motors block the water automatically after the sand attains its maximum value which is distinct by user. Always the motor on or off spontaneously, the farmer will get a message about the state of action. The most favour of the scheme comprises prevention from water wastage, improvement of plant's growth to attain high dormant, smaller possibilities of erratum due to fewer efforts and continuous water supply due to solar energy.

Limitations:

This system works on solar which is to be replaced with AC power.

**C. Soil moisture monitoring using IoT enabled arduino sensors with neural networks for improving soil management for farmers and predict seasonal rainfall for planning future harvest in North Karnataka — India Authors : Suhas Athani , C H Tejeshwar , Mayur M Patil , Priyadarshini Patil , Rahul Kulkarni
Published in: 2017 International Conference on I-SMAC (IoT in Social, Mobile, Analytics and Cloud) (I-SMAC) , IEEE 05 October 2017**

Appropriate soil moisture level is a compulsory state for conceptual greenery improvement. Soil moisture being a key feature for life aliment, it is the necessity to evade its extravagant manipulation. A dominant user of water is called irrigation. It is necessary to manage water supply for irrigation process. Plants should not be over-irrigated and under-irrigated. Sand surveillance is a popular apparatus to give soil instruction. Always, schemes have been appealed so to reach this register target of which computational function are highly approved as authorize information to be collected at high desire with less employment pressure. Schemes produce various technological ascendancy but are expensive, big, complex to support and not so much accepted by the scientifically unskilled workers in the agrarian design. Main goal of this scheme is to delineate a controllable, simple to establish performance to discover & enumerate the amount of water content of soil is continually controlled with a vision to achieve peak greenery improvement and closely amplify with the achievable irrigation accumulation. In this scheme we utilize the information achieved from the sensors that is controlled by utilizing the neural networks algorithm and rectification elements for controlling. Soil observing, provides a sequence of reviews giving how sand state and belongings change at the time. The utilization of attainable elements reduces the building and conservation expenses. It constructs this scheme as low-priced, correct and low preservation result for demand, generally in villages & for simple agriculturists.

Limitations: These schemes gave various technological predominance but very expensive, greater, complex to keep up and lowly accepted by the technologically unskilled workers in the agrarian design.

**D. Retrieval of soil moisture with airborne and satellite microwave sensors
Authors: E. Santi, S. Paloscia, P. Pampaloni, S. Pettinato M. Brogioni
Published in: 2009 IEEE International Geoscience and Remote Sensing Symposium**

Speculative battles with soaring and satellite microwave sensors had been used in farming field with the important requirement of assembling a convenient information to approve 2 functional theorems cultivated to regain sand water level from inactive and active sensors at disparate dimensional areas. The theorems should be accustomed in an



enterprise depends on the use of world surveillance information in calculating & controlling the prospect of landslides and floods. The output values have been accumulated with soaring equipments called IFAC, while images had been taken for elevated determination appraisal of watery state of the soil at agricultural area.

IV. METHODOLOGY

The approach used for the smart innovation system discussed in this is embraced after inspecting and bringing the above literatures.

E. Software and Hardware components

The tasks have done with both on hardware and software. The essential components are,

- Personal computer
- Arduino software
- Arduino Uno Board (ATMega 328P)
- Soil moisture sensor (FC 28)
- Humidity & Temperature sensor (DHT11)
- GSM module (SIM900D)
- GPRS
- SIM CARD and Network operator
- Embedded C and Libraries

F. Arduino Uno Board (Arduino AT Mega328P)

Arduino Uno board is a microcontroller based on the ATmega328P. It is having fourteen i/p and o/p pins (six of those pins utilized as Pulse Width Modulation outputs), six analogue i/p, a sixteen crystal MegaHertz quartz, a power jack, a Universal Serial Bus interrelation, a reset pin and an In-Circuit Serial Programming header. Arduino uno holds entirely desired to keep the microcontroller; merely interrelate it with a personal computer with a Universal Serial Bus or power cable it with Alternating Current to Direct Current battery or adapter to become establish. The Arduino Uno board is the first in a sequence of USB Arduino boards, and the intimation example for the Arduino platform; for an ample list of power, outdated or old boards see the Arduino index of boards.



Fig 1. Arduino Uno Board

G. Soil Moisture Sensor (FC 28)

These sensors evaluate the water state of the sand or soil. The soil moisture sensors used to monitor watery state of the soil or sand. Moisture requires drying, removing and sample weighting, moisture level of the soil responsible for evaluate the water content periphrastrically by additional characteristic of the sand or soil that is galvanic counteraction, insulator perpetual as a delegate for the watery content of the soil. The

proportion among the evaluated characteristic and watery state of the soil should be balanced and will change according to the climate factors that are soil breed, temperature or electric conductivity. Contemplated radiation of microwave is pretended using the watery state of the soil & which is utilized for outlying deducting in fluviology and farming. The probe of the portable sensor's equipments should be used farmers or gardeners.



Fig2.Moisture sensor

Those sensors commonly concern to metal detector that gauge state of the water substance. Alternative division of metal detector evaluate another characteristic of watery content in sand or soil called potential of water these metal detectors are generally mentioned to as sand water immanent metal detector and contain gypsum bricks and tensiometers. The moisture metal detector evaluates the amount of water comprised in a substantial, such as soil on a gravimetric or volumetric support. To acquire an exact evaluation, a soil temperature sensor is also need for appraisal. Moisture brings up to the existence of a fluid, particularly water, generally in discover amounts. Little amounts of water may be established, for example, in the humidity (air), in nourishment, and in different materialistic products. Moisture also relate to the quantity of water drizzle benefaction in the air.

H. Humidity And Temperature Sensor (DHT 11)

This DHT11 Humidity and Temperature Sensor characteristics a measured digital signal output with the humidity and temperature sensor hard. Its technology safeguards the high authenticity and superior long-term endurance. A high-accomplishment 8-bit microcontroller is associated. This sensor contains a resistive component and a sense of moisture NTC temperature evaluating devices. It has superior property, quick acknowledgement, anti-interference capability and high cost operation benefits.

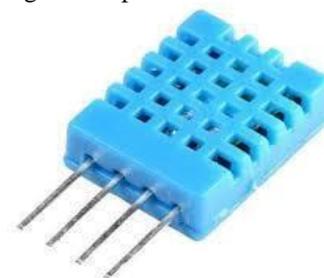


Fig3.DHT11 Humidity and Temperature

Each DHT11 sensors characteristics awfully correct appraisal of wetness calibration cubicle. The standardization coefficients amassed in the OTP program remembrance, domestic sensors observe signals in the method, we should call these standardization coefficients. The single-wire serial interact system is amalgamated to become easy and quick. Less power, Small size, signal broadcast distance up to 25 meters, making it a abnormity of applications and even the most exacting applications. The system is 4-pin separate row pin wrap. Commodious connection, specific packages can be equipped according to users need.

I. GSM

GSM (Global System for Mobile Communications) is a universal criterion for cell phones. It is occasionally alluding to as Second-generation, as it is a 2G n/w. GPRS (General Packet Radio Service) is used for internet access, and for Arduino uno to demand or assist web pages, we require achieving the (APN) Access Point Name and a password and a username from the n/w operator. Look the data in uniting to the Internet for additional data about utilizing the information proficiency of the system.

Amongst other things, GSM holds incoming and outgoing audio calls, Simple Message & information transmission. The Global System for Mobile Communications (GSM) is the Global System for Mobile Communications modem. Hence the phone operator's viewpoint, this is exactly like a mobile phone.

J. GPRS

Packet switching technology is the GPRS that implies General Packet Radio Service. This gives idealistic information between 55-115 kilobit p/sec.

The technologies that rely on General Packet Radio Service to method. With the Global System for Mobile Communications shield, this is achievable to influence information transmission to approach the mobile network. Correspondent to the WiFi libraries and Ethernet, the General Packet Radio Service implies the Uno shield to behave as a server/client, by utilizing the http (Hypertext Transfer Protocol) appeals to receive and send web pages.

K. Network Operator and SIM CARD

To avenue the network & mobile internet, we should have a beneficitation with a network operator (either contract or prepaid), a Global System for Mobile (GSM) compliant apparatus like the mobile phone or GSM shield, & a benefactor closeness SIM card. The network operator affords the SIM card that includes data like the phone number, & which can accumulate finite number of SMS messages & contacts.

To utilize General Packet Radio Service (GPRS) for network access, this module is to serve or appeal web pages; we demand to acquire the APN & password (or) a username from the internet provider. Regard this information, securing to the network for high information about utilizing the information characteristics of the system.

To use Arduino and GSM we require SIM. This stand for abbreviate with an information provision operator, who trading us the system has to give GSM description there we have a drifting agreement with an organization given that the Global System for Mobile Communications cover with in our whereabouts.

It's general for these cards to hold 4-digit pin number confederate with system for safety needs. Remain annotation of the pin no, as it's essential for network connection.

If we forget the number confederate with our card, we shall require contacting our internet operator to reclaim that. Certain these cards get secured if we enter pin number again and again. If we are having doubt of what the number is, the confirmation that combine with our Mobile Number.

Exploitation with PUK, this is achievable for immigrate forgotten number with an Arduino and the Global System for Mobile Communications. The PIN Unlock Code number will appear with our SIM card.

Observe the pin supervision case in the "tools" folder, enveloped with the Global System for Mobile library is used. There are some cards with different sizes; the Global System for Mobile Communication tolerates sims in small- size (20mm * 10mm).

Comment on Movilforum/Telefonica SIM comprised with the shelter.

The GSM shelter comes enveloped with a SIM from Movilforum/Telefonica that will operate well for improving (M2M) machine to machine applications. It is not important to use this particular card with the shelter. We may use any SIM that process on a network in our location.

The Movilforum/Telefonica card contains a rambling plan. It can be accustomed on any System for Mobile Communication network. There is a description that Europe and Americas for the sim, contol the Movilforum/ Telefonica employment accessibility side for individual nation that have affirmed network. Actuation of the card is managed by Movilforum/Telefonica. Elaborated information on how to enter and actuate our SIM card online and affix faith are comprised on a little brochure that arrives with our shelter. The SIM card could be included into an invigorated GSM shelter that is fixed on an Arduino board for actuation.

The card arrives without a pin number, but it is feasible to put one adopting the Global System for Mobile Communication library's GSM pin group. We cannot use the included SIM to receive or place audio calls. We can only receive and place message with other sims on the Movilforum/Telefonica network. It's not achievable to establish a server that acknowledges arriving requests from the general internet. However, the Movilforum/Telefonica sim card will receive arriving requests from other sim cards on the Movilforum/ Telefonica network.

For accepting the audio and other operations of the shelter, we'll need to determine a various network supplier will have various management for their sim cards, restrain with them straightly to establish what group of attachments are affirmed.

L. Embedded C and Libraries

Embedded C is a group of language elongations for the C programming language by the C pennant group to discourse populace problems that occur among C language extensions for various engraft scheme. Principality, engraft C programming needs imprecise engrafts to the C language in grade to tolerate strange characteristics such as determined-level computation, compound evident recollection groups, and primary Input/Output functions.

Libraries afford additional serviceability for custom in delineates, example, functioning with manipulating data or hardware. To apply a library in the delineates, choose it from the delineate > Import program Library menu. This will include 1 or more #include affirmation at the exceed of the delineate and accumulate the program library with our delineate. Because program libraries are connected to the board with our delineate, they amplify the bulk of distance it receives up. If a delineate no lengthy requires a program library, simply remove its #include declarations from the exceed of our code.

There is a group of program libraries in the allusion. Some program libraries are comprised with the Arduino groupware. Others can be computed from a different authority or around the program Library superintendent. Beginning with version 1.0.5 of the IDE, we do can consequence a program library from a zip file and utilize it in an accessible delineates. Look these statements for establishing a 3rd-party program library. A least possible Arduino C++/C delineates, as looked by the IDE operator, contains only 2 methods:

- Setup()
- Loop()

Almost Arduino boards involves a (LED) light-emitting diode and a load resistor coupled between ground and pin thirteen, which is a useful characteristics for more tests and program methods. A classic program for a starting the Arduino programmer.

V. PROPOSED SYSTEM & RESULTS

The initiated scheme is an estimation scheme for moisture level of the sand or soil, temperature and humidity. The advanced system is that declines to that itself turns off and on according to the soil moisture demand, which instinctive proceeding of soaking has executed by various sensors that purport & give the customer if moisture is need. The failures that could appear at the time of manual soaking is consumed are corrected for the bulk part by this system. States where farming has a huge collision on savings requirement exceedingly effectual method of soaking or irrigation. A convenient and reliable soaking is required of the time in that states. There the need of moisture is not admissible by the sand/soil at the time of irrigation; the extra water is not optional for crops. Accordingly an achievable irrigation for any area needs appropriate amount of water with fewer amounts of dawdles. Present earth requires enhanced functions as correlated to the previous ones to accomplish progresses quicker & the world is moving according to the industrialization method. In this planned scheme, instinctive ablation scheme had been recommended which blemish the soil moisture content and planned in the path that if water level passes less needed quantity, which involuntarily on the pipes to deliver water. By this, highest outcomes are obtained out by the area and water expenditure is also decreased to noteworthy state.

VI. WORKING PRINCIPLE

A necessary functioning truth of the scheme is straightforward to recognize. This scheme has separated into slighter circuit. Used sensors are inundated into sand & attached again with the main scheme. These sensors provide information of moisture state of the soil/sand and this information can be viewed on monitor. An additional connection is the Global System for Mobile Communications

component. This is associated with Arduino uno & which is dependable of forwarding data of each action delightful position to the user. In the regulations, there is fundamentally 2 doorstep data that is lower & upper. The regulations hold those 2 data & are definite by end user. The real data moisture in the sand is examine by the sensors that are immersed in sand. The regulations differentiates those data with 2 consumer clarified doorstep values.

Advantages:

- Low price and an inventive scheme to be familiar with the moisture level of the soil from a distant position
- prevention from water wastage
- enlargement of plants to their upper limit prospective
- a lesser amount of probability of mistake due to less employment and never-ending supply of water
- Less Power required.

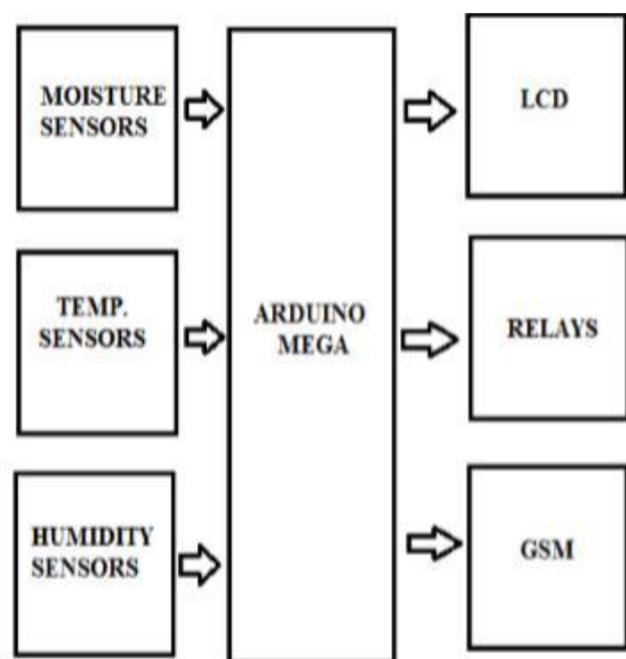


Fig4. Block diagram of the System

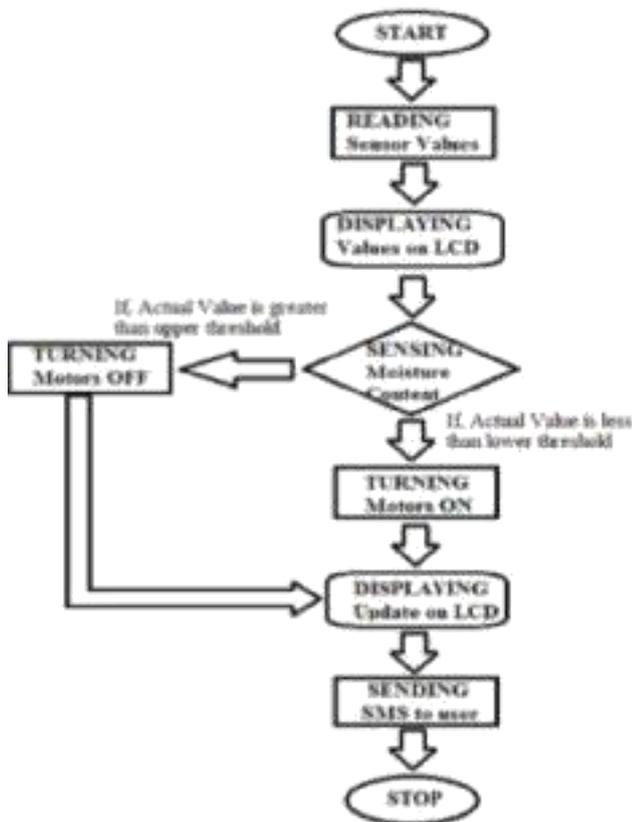


Fig 6.FlowChart of processes

VII. FUTURE WORK

The scheme should be created adaptable by using additional components. The increase of more components like sensors can raise the exact and accurate moisture level in computation. The initiated system calculates an accurate moisture level. The next level of this project is to fix a solar system & more components to increase the efficiency of the system.

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