

Smart Agriculture System based on IoT

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Abstract: - Some issues on agriculture have been continually impeding the agricultural growth. The solution for this issue is keen farming by modernizing the current conventional techniques for agribusiness. This paper targets making farming shrewd utilizing computerization and IoT innovations. The featuring highlights of this venture incorporates smart GPS based remote controlled robot to perform undertakings like weeding, showering, dampness detecting, feathered creature and creature startling, keeping cautiousness, and so forth. Secondly, it incorporates smart irrigation system with brilliant control and intelligent decision making based on real time data. Thirdly, keen distribution center administration which incorporates temperature upkeep, moistness support and robbery recognition in the distribution center. Controlling of every one of these activities will be through any remote savvy gadget or PC associated with Internet and the tasks will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera and actuators with miniaturized scale controller and raspberry pi.

Key words: IoT, smart agriculture, Raspberry pi, soil moisture sensor, wifi, automation.

1. INTRODUCTION

Agribusiness is considered as the premise of life for the human species as it is the fundamental wellspring of sustenance grains and other crude materials. It assumes imperative job in the development of nation's economy. It likewise gives enormous abundant business chances to the individuals. Development in horticultural area is important for the improvement of monetary state of the nation. Lamentably, numerous ranchers still utilize the customary strategies for cultivating which results in low yielding of harvests and natural products. Be that as it may, any place robotization had been actualized and people had been supplanted by programmed apparatuses, the yield has been improved. Consequently there is have to actualize current science and innovation in the farming part for expanding the yield. The majority of the papers mean the utilization of remote sensor arranges which gathers the information from various kinds of sensors and after that send it to principle server utilizing remote convention. The gathered information gives the data about various ecological elements which in goes screens the framework.

Observing ecological elements isn't sufficient and complete arrangement to improve the yield of the harvests. There are number of different variables that influence the profitability to incredible degree. These components incorporate assault of bugs and irritations which can be constrained by splashing the harvest with appropriate bug spray what's more, pesticides. Also, assault of birds and animals at the point when the harvest grows up. There is additionally plausibility of robberies at the point when yield is at the phase of reaping. Indeed, even after reaping, ranchers additionally face issues away of collected yield. Along these lines, so as to give answers for all such issues, it is important to create coordinated framework which will deal with all elements influencing the profitability in each stage like; development, reaping what's more, post collecting stockpiling. This paper consequently proposes a framework which is valuable in observing the field information as well as controlling the field tasks which gives the adaptability. The paper targets making horticulture savvy utilizing mechanization and IoT innovations. The featuring highlights of this paper incorporates brilliant GPS based remote controlled robot to perform errands like; weeding, showering, dampness detecting, fowl and creature startling, keeping carefulness, and so forth. Besides, it incorporates keen water system with shrewd control dependent on constant field information. Thirdly, keen distribution center administration which incorporates; temperature upkeep, stickiness support and robbery discovery in the stockroom. Controlling of every one of these activities will be through any remote shrewd gadget or PC associated with Web and the activities will be performed by interfacing sensors, Wi-Fi or ZigBee modules, camera and actuators with smaller scale controller and raspberry pi.

2. LITERATURE REVIEW

The fresher situation of diminishing water tables, evaporating of streams and tanks, capricious condition present an earnest need of legitimate use of water. To adapt up to this utilization of temperature and dampness sensor at appropriate areas for checking of yields is actualized in.[1] A calculation created with limit estimations of temperature and soil dampness can be modified into a microcontroller-based portal to control water amount.[2] The framework can be fueled by

photovoltaic boards and can have a duplex correspondence connection dependent on a cellularInternet interface that permits information investigation and water system booking to be modified through a website page. [4]The innovative advancement in Wireless Sensor Systems made it conceivable to use in observing and control of nursery parameter in exactness horticulture. After the exploration in the horticultural field, analysts discovered that the yield of agribusiness is diminishing day by day. Be that as it may, utilization of innovation in the field of horticulture assumes significant job in expanding the creation just as in decreasing the additional labor endeavors.[5] A portion of the research endeavors are accomplished for advancement of ranchers which gives the frameworks that utilization innovations supportive for expanding the rural yield. A remote detecting and control water system framework utilizing appropriated remote sensor system going for variable rate water system, continuous in field detecting, controlling of a site explicit accuracy straight move water system framework to amplify the efficiency with negligible utilization of water was created by Y. Kim .[6] The framework depicted insights concerning the structure and instrumentation of variable rate water system, remote sensor system and constant in field detecting and control by utilizing proper programming. [7]The entire framework was created utilizing five in field sensor stations which gathers the information and send it to the base station utilizing worldwide situating framework (GPS) where essential activity was taken for controlling water system as per the database accessible with the framework.[8] The framework gives a promising ease remote arrangement just as remote controlling for exactness water system. In the investigations identified with remote sensor organize, scientists estimated soil related parameters, for example, temperature and mugginess. Sensors were put underneath the soil which speaks with hand-off hubs by the utilization of successful correspondence convention giving exceptionally low obligation cycle and henceforth expanding the existence time of soil observing framework. [9] The framework was created utilizing microcontroller, general offbeat recipient transmitter (UART) interface and sensors while the transmission was finished by hourly inspecting and buffering the information, transmit it and at that point checking the status messages.[10] The disadvantages of the framework were its expense and organization of sensor under the soil which causes constriction of radio recurrence (RF) signals.

3. SYSTEM OVERVIEW

The paper comprise of four segments; node1, node2, node3 also, PC or portable application to control framework. In the present framework, each hub is

incorporation with various sensors what's more, gadgets and they are interconnected to one focal server by means of remote correspondence modules. The server sends and gets data from client end utilizing web network. There are two methods of activity of the framework; auto mode and manual mode. In auto mode framework takes its very own choices and controls the introduced gadgets while in manual mode client can control the tasks of framework utilizing android application or PC directions.

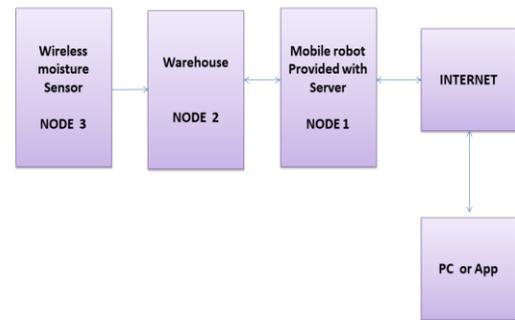


Figure 1: system overview

System Architecture:

Node1 is GPS based portable robot which can be controlled remotely utilizing PC just as it very well may be customized in order to explore independently inside the limit of field utilizing the co-ordinates given by GPS module. The Remote controlled robot have different sensors and gadgets like camera, obstruction sensor, alarm, shaper, sprayer what's more, utilizing them it will perform undertakings like; Keeping cautiousness, Bird and creature startling, Weeding, and Showering.

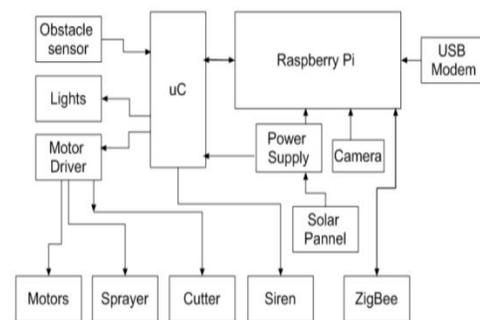


Figure 2: Mobile robot (NODE 1)

Node2 will be the stockroom. It comprises of movement indicator, light sensor, mugginess sensor, temperature sensor, room radiator, cooling fan through and through interfaced with AVR microcontroller. Movement indicator will recognize the movement in the room when security mode will be ON and on identification of movement, it will

send the alarm sign to client by means of Raspberry pi and along these lines giving burglary recognition. Temperature sensor and Humidity sensor detects the temperature and dampness individually and if the worth crosses the edge at that point room radiator or cooling fan will be exchanged ON/OFF naturally giving temperature what's more, moistness maintenance. Node2 will likewise controls water siphon contingent on the dirt dampness information sent by node3.

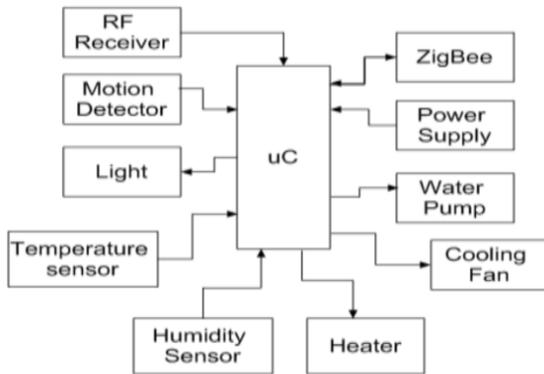


Figure 3: Warehouse (NODE 2)

Node3 is a keen water system hub with highlights like; Smart control of water siphon dependent on continuous field information for example consequently turning on/off the siphon in the wake of achieving the required soil dampness level in auto mode, Switching water siphon on/off remotely by means of versatile or PC in manual mode, and ceaseless observing of soil dampness. In node3, dampness sensor transmits the information utilizing HT12E Encoder IC and a RF transmitter. The transmitted information is gotten by node2 and there it is prepared by microcontroller so as to control the activity of water siphon.

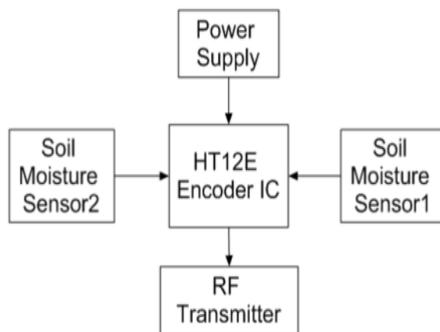


Figure 4: Wireless moisture sensor (NODE 3)

3.1 Hardware Used

a) AVR Microcontroller Atmega 16/32: The microcontroller utilized is, Low-control AVR@ 8-piece Microcontroller, having 8K Bytes of In-System Selfprogrammable Flash program memory, Programmable Serial USART, 8-channel, 10-piece ADC, 23 Programmable I/O Lines.

b) ZigBee Module: ZigBee is utilized for accomplishing remote correspondence somewhere in the range of Node1 and Node2. The range for Zigbee is approximately 50 meters and it very well may be expanded utilizing high control modules or by utilizing system of modules. It works on 2.4 GHz recurrence. Its capacity utilization is low and it is more affordable when contrasted with different remote modules like Wi-Fi or Bluetooth. It is generally used to build up remote neighborhood.

c) Temperature Sensor LM35: The LM35 is exactness IC temperature sensor. Yield voltage of LM35 is straightforwardly corresponding to the Centigrade/Celsius of temperature. The LM35 needn't bother with outer alignment or cutting to give exact temperature extend. It is exceptionally minimal effort sensor. It has low yield impedance and straight yield. The working temperature go for LM35 is -55° to $+150^{\circ}\text{C}$. With ascend in temperature, the yield voltage of the sensor increments straightly and the estimation of voltage is given to the microcontroller which is increased by the change factor so as to give the estimation of actual temperature.

d) Moisture sensor: Soil dampness sensor estimates the water content in soil. It utilizes the property of the electrical obstruction of the dirt. The relationship among the deliberate property and soil dampness is adjusted and it might shift contingent upon natural factors, for example, temperature, soil type, or electric conductivity. Here, It is utilized to detect the dampness in field and move it to microcontroller so as to make controlling move of exchanging water siphon ON/OFF.

Stickiness sensor: The DHT11 is an essential, minimal effort computerized temperature and moistness sensor. It gives out computerized esteem and thus there is no compelling reason to utilize change calculation at ADC of the microcontroller and consequently we can give its yield straightforwardly to information stick rather than ADC. It has a capacitive sensor for estimating stickiness. The main genuine weakness of this sensor is that one can just get new information from it simply after at regular intervals.

e) Obstacle sensor (Ultra-Sonic): The ultra-sonic sensor works on the rule of sound waves and their appearance property. It has two sections; ultrasonic transmitter and

ultra-sonic recipient. Transmitter transmits the 40 KHz sound wave and recipient gets the reflected 40 KHz wave and on its gathering, it sends the electrical sign to the microcontroller. The speed of sound in air is as of now known. Henceforth from time required to get back the transmitted sound wave, the separation of obstruction is determined. Here, it is utilized for deterrent discovery if there should be an occurrence of versatile robot and as a movement locator in product house for avoiding robberies. The ultra-sonic sensor empowers the robot to identify and stay away from deterrents and furthermore to quantify the good ways from the obstruction. The scope of activity of ultra-sonic sensor is 10 cm to 30 cm.

f) Raspberry Pi: The Raspberry Pi is little pocket size PC used to do little processing and systems administration activities. It is the fundamental component in the field of web of things. It gives access to the web and subsequently the association of computerization framework with remote area controlling gadget winds up conceivable. Raspberry Pi is accessible in different adaptations. Here, model Pi 2 model B is utilized and it has quad-center ARM Cortex-A53 CPU of 900 MHz, and RAM of 1GB. it likewise has: 40 GPIO pins, Full HDMI port, 4 USB ports, Ethernet port, 3.5mm sound jack, camcorder interface (CSI), the Display interface (DSI), and Micro SD card opening.

3.2 Virtual products utilized

a) AVR Studio Version 4: It is utilized to compose, fabricate, accumulate and investigate the implanted c program codes which are should have been scorched in the microcontroller so as to perform wanted activities. This product straightforwardly gives .hex document which can be effectively singed into the microcontroller.

b) Proteus 8 Simulator: Proteus 8 is outstanding amongst other reproduction programming for different circuit structures of microcontroller. It has practically all microcontrollers and electronic segments promptly accessible in it and thus it is broadly utilized test system. It very well may be utilized to test projects and implanted structures for gadgets before real equipment testing. The recreation of programming of microcontroller should likewise be possible in Proteus. Recreation stays away from the danger of harming equipment because of wrong structure.

c) Dip Trace: Dip race is EDA/CAD programming for making schematic outlines and printed circuit sheets. The designers give multi-lingual interface and instructional exercises (as of now accessible in English and 21 different dialects). DipTrace has 4 modules: Schematic Capture Editor, PCB Layout Editor with implicit shape-based auto

switch and 3D Preview and Export, Component Editor, and Pattern Editor.

d) SinaProg: SinaProg is a Hex downloader application with AVR Dude and Fuse Bit Calculator. This is utilized to download code/program and to set circuit bits of all AVR based microcontrollers.

e) Raspbian Operating System: Raspbian working framework is the free and open source working framework which Debian based and advanced for Raspberry Pi. It gives the fundamental arrangement of projects and utilities for working Raspberry Pi. It accompanies around 35,000 bundles which are pre-assembled programming projects that are packaged in a decent group for hustle free establishment on Raspberry Pi. It has great network of designers which runs the discourse shapes and gives answers for some pertinent issues. Be that as it may, Raspbian OS is still under steady improvement with a primary spotlight on improving the presentation and the solidness of whatever number Debian bundles as would be prudent.

4. EXPERIMENTAL RESULT

As appeared in figure 5, experimental arrangement for node1 comprises of versatile robot with focal server, GPS module, camera and other sensors. All sensors are effectively interfaced with microcontroller and the microcontroller is interfaced with the raspberry pi. GPS and camera are moreover associated with raspberry pi. Test outcomes demonstrates that the robot can be controlled remotely utilizing remote transmission of PC directions to R-Pi. R-Pi advances the directions to microcontroller and micocontroller offers sign to engine driver so as to drive the Robot. GPS module gives the co-ordinates for the location and area of the robot.



Figure 5: Experimental setup for mobile robot with server (NODE 1)

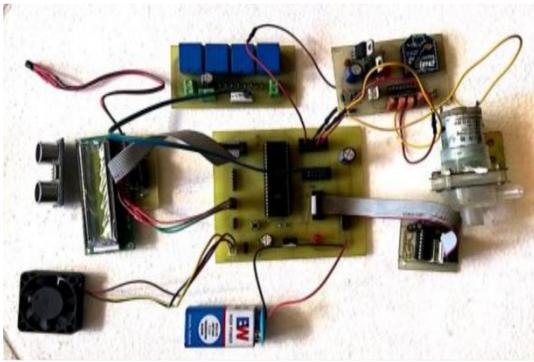


Figure 6: Experimental setup for Warehouse (NODE 2)

As shown in above figure, node2 comprises of movement identifier, temperature sensor, stickiness sensor, cooling fan, water siphon, and so on associated with the microcontroller board. The sensors offers contribution to the controller and as per that microcontroller controls the gadgets in auto mode and additionally sends the estimation of sensors to R-Pi and R-Pi advances it to client's brilliant gadget utilizing web. Test outcomes appears that when temperature level increments above preset edge level at that point cooling fan is begun consequently in auto mode. The water siphon additionally gets turned ON if dampness level goes underneath fixed limit esteem. In manual mode, microcontroller gets the controlling sign from R-Pi through ZigBee and in like manner makes the control move.



Figure 7: Experimental setup for wireless moisture sensor (NODE 3)

5. CONCLUSION

The sensors and microcontrollers of every one of the three Nodes are effectively interfaced with raspberry pi and remote correspondence is accomplished between different Nodes. All perceptions and test tests demonstrates that undertaking is a finished answer for field exercises, water system issues, and capacity issues utilizing remote controlled robot, keen water system framework and a

savvy distribution center the executives framework separately. Usage of such a framework in the field can improve the yield of the harvests and by and large creation.

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