MONITORING SYSTEM INSMART AGRICULTURE BASED ON IOT

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ABSTRACT: Internet of Things (IoT) plays a crucial role in smart agriculture. Smart farming is an emerging concept, because IoT sensors capable of providing information about their agriculture fields. The paper aims making use of evolving technology i.e. IoT and smart agriculture using automation. Monitoring environmental factors is the major factor to improve the yield of the efficient crops. The feature of this paper includes monitoring temperature and humidity in agricultural field through sensors using CC3200 single chip. Camera is interfaced withCC3200 to capture images and send that pictures through MMS to farmers mobile using Wi-Fi.

Keywords— IoT, Temperature, NWP, CC3200

I. INTRODUCTION

Internet of Things (IoT) is widely used in connecting devices and collecting data information. Internet of Things is used with IoT frameworks to handle and interact with data and information. In the system users can register their sensors, create streams of data and process information. IoT are applicable in various methodologies of agriculture. Applications of IoT are Smart Cities, Smart Environment, Smart Water, Smart Metering, Security and Emergency, Industrial Control, SmartAgriculture, Home Automation, e-Health etc. 'Internet of Things' is based on device which is capable of analyzing the sensed information and then transmitting it to the user.

Why do we need IOT in agriculture?

From survey of United Nations – Food and Agriculture Organizations, the world wide food production should be increased by 70% in 2050 forevolving population. Agriculture is the basis for thehuman species as it is the main source of food and it plays important role in the growth of country's economy. It also gives large ample employment opportunities to the people. The farmers are still using traditional methods for agriculture, whichresults in low yielding of crops and fruits. So the crop yield can be improved by using automatic machineries. There is need to implement modern science and technology in the agriculture for increasing the yield. By using IoT, we can expect the increase in production with low cost by monitoring the efficiency of the soil, temperature and humidity monitoring, rain fall monitoring, fertilizers efficiency, monitoring storage capacity of water tanks and also theft detection in agriculture areas.

The combination of traditional methods with latest technologies as Internet of Things and Wireless Sensor Networks can lead to agricultural modernization. The Wireless Sensor Network which collects the data from different types of $_8$sensors and send it to the main server using wireless protocol. There are many other factors thataffect the productivity to great extent. Factors include attack of insects and pests which can be controlled by spraying the proper insecticide and pesticides and also attack of wild animals and birds when the crop grows up. The crop yield is declining because of unpredictable monsoon rainfalls, water scarcity and improper water usage.

II. RELATED WORKS

Nikesh Gondchawar et al., [1] proposed work on IoT based smart agriculture. The aim of the paper is making agriculture smart using automation and IoT technologies. Smart GPS based remote controlled robot will perform the operations like weeding, spraying, moisture sensing etc. It includes smart irrigation with smart control and intelligent decision making based on accurate real time field data and smart warehouse management. It monitors temperature maintenance, humidity maintenance and theft detection in the warehouse. All the operations will be controlled by smart device and it will be performed by interfacing sensors, ZigBee modules, camera and actuators with micro- controller and raspberry pi. All the sensors and microcontrollers are successfully interfaced with three Nodes using raspberry pi and wireless communication. This paper gives information about field activities, irrigation problems, and storage problems using remote controlled robot for smart irrigation system and smart warehouse management system respectively.

Rajalakshmi P.et.al., [2] described to monitor the crop-field using soil moisture sensors, temperature and humidity sensor, light sensor and automated the irrigation system. The data from sensors are sent to web server using wireless transmission and JSON format is used for data encoding to maintain server database. The moisture and temperature of the agriculture field falls below the brink, irrigation system will be automated. The notifications are sent to farmers mobile periodically and farmers can be able to monitor the field conditions from anywhere. The parameters used here are soil moisture sensor, temperature and humidity sensor- DHT11, LDR used as light sensor and web server – NRF24L01 used for transmitter and receiver. This system will be more useful in areas where water is in scarcity and it is 92% more efficient than the conventional approach. Automation of irrigation system data was stored in MySQL database using PHP script. Total average power consumption is 2 Ah per day for a single motor pump and water requirement analysis.

Tanmay Baranwal et al., [3] this project concentrates security and protection of agricultural products from attacks of rodents or insects in the fields or grain stores. Security systems are used to provide real time notification after sensing the problem. Sensors and electronic devices are integrated using Python scripts. Algorithm is designed based on collecting information to provide accuracy in notifying user and activation ofrepeller. Testing is done in an area of 10 sq. m. andthe device is placed at the corner. The PIR sensor identifies heat it starts URD sensor and webcam. Based on attempted test cases 84.8% success is achieved. It will be helpful to extend the security system to prevent rodents in grain stores.

Nelson Sales et al., [4] this paper describes Wireless sensor Networks. The network performs three nodes i.e. acquisition, collection and analysis of data such as temperature and soil moisture. The benefits of irrigation process in agriculture are decreasing water consumption and environmental aspects. Cloud Computing is an attractive solution for high storage and processing capabilities of large amount of data by the Wireless Sensor and Actuator Network. This work aims to agriculture, greenhouses, golf courses and landscapes. Architecture is divided in to three main components: a WSAN component, a cloud platform component and a user application component. It contains three different types of nodes such as sink node, a sensor node and an actuator node. SimplitiTI is a simple protocol for WSAN implementation in a cluster tree topology. The soil moisture monitors to assess the plants it need water for its proper development and optimization of natural resources.

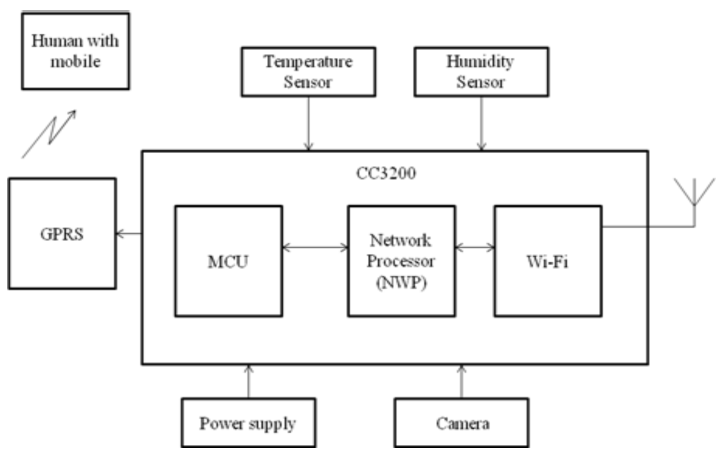
Mohamed Rawidean Mohd Kassim et al., [5] this work describes a Precision Agriculture (PA).

A WSN is the best way to solve the agricultural problems like farming resources optimization, decision making support, and land monitoring. Using this approach provides real-time information about the lands and crops that will help the farmers to make right decisions. Precision agriculture systems based on the IOT technology explains the hardware architecture, network architecture and software process control of the precision irrigation system. The software collects data from the sensors in a feedback loop depending on that activates the control devices based on threshold value. Implementation of WSN in PA optimizes the usage of water fertilizer through irrigation and also maximized the yield of the crops.

LIU Dan et al., [6] this paper describes greenhouse technology in agriculture represents the design and implementation based on ZigBee technology using CC2530 chip. It is mainly used for environment monitoring system. The wireless sensor and control nodes uses CC2530F256 core for data acquisition, data processing, data transmission and reception. Here computer provides all the real time data for the concerned person using wireless communication like temperature control, fans condition. In this system uses intelligent monitoring and control of green house. It is helpful to farms for scientific and balanced planting crops.

III. PROPOSED SYSTEM MODEL

Fig1 shows the block diagram of proposed system model.



specific conditions for optimal growth and health. Monitoring the condition of crop field is very much necessary so sensors are used. Temperature infrared thermopile sensor- TMP007 is used, it has built in digital control and math engine. It senses the temperature values in real time and humidity sensor- HDC1010 track the relative moisture of air within the farming field. Camera is interfaced with CC3200 camera booster pack via PCB using MT9D111 camera sensor. This is used to capture current images of the particular field those images are sent to the farmer through GPRS.

IV. SYSTEM DESIGN

Description of CC3200 Launchpad:

CC3200 Single chip with integrated microcontroller, network processor (NWP) and Wi- Fi. CC3200 contains the networking sub-system along with an internal MCU application processor. It is the first high performance Wi-Fi wireless microcontroller with user-dedicated functions and integrates CC3100 benefits. MCU has 200kB of application code available fully independent from the Wi-Fi processing. The peripherals includes parallel camera, ADC, SPI, UART, I2C, PWM, I/Os, built-in power management and RTC. CC3200 belong to wireless networking devices consist of a full network stack over 802.11bgn. In CC3200 user programming controls the power mode of the microcontroller through the networking sub-system

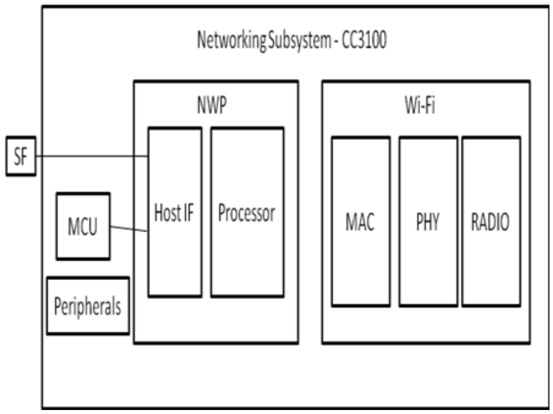


Fig 2: Block Diagram of CC3200

The CC3200 LaunchPad is a low-cost and faster development evaluation platform for based microcontrollers and mainly concentrating on low power. It has features like programmable user buttons, RGB LED for custom applications and onboard emulation for debugging. So many BoosterPack add-on boards are available for interfacing peripherals such as graphical displays, antenna selection, environmental sensing etc.

Important Features of CC3200

- Internet-on-a-chip solution with integrated microcontroller.
- 40-pin LaunchPad and BoosterPack ecosystem.
- JTAG emulation with serial port for Flash programming.
- User interaction through two buttons and three LEDs.
- Universal asynchronous receiver/transmitter through USB to PC
- On-board chip antenna.

Power Modes: CC3200 has power modes based on following three aspects. Power mode of microcontroller subsystem is controlled by MCU application. Power mode of NWP maintained automatically and chip level power mode is controlled by the combination of MCU and NWP mode.

MCU POWERMODES	Networking sub systems		
	Disabled	LPDS	Active
Hibernate	Hibernate	N/A	N/A
LPDS	LPDS	LPDS	Active
Sleep	Active	Active	Active
Active	Active	Active	Active

Table1: CC3200 Power Modes

Temperature Sensor (TMP007): In this work TMP007 temperature infrared thermopile sensor is used which has built in math engine. This sensor absorbs energy from an object and wavelengths between 4 um to 16 um within the defined field. The fig 3 shows the internal block diagram of TMP007.

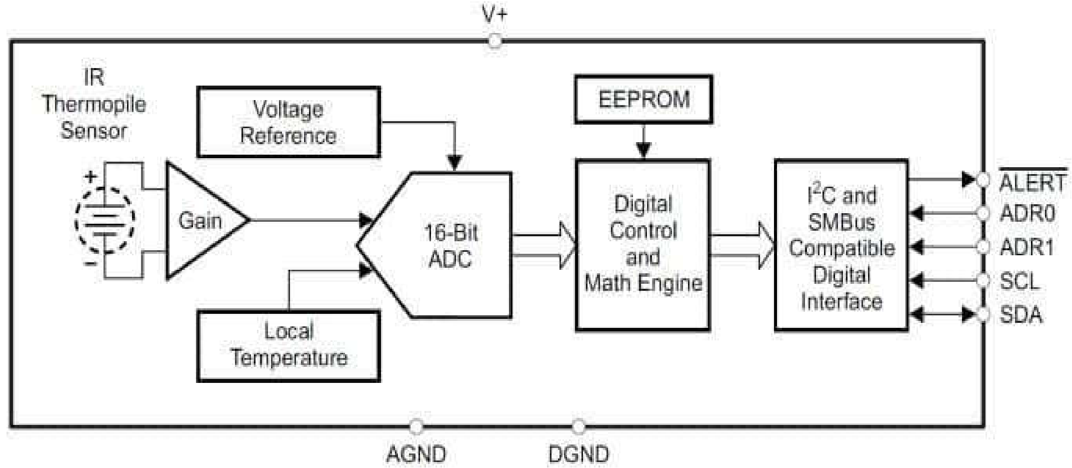


Fig 3: Internal block diagram of TMP007

It consists math engine, senses the analogous change in voltage across the thermopile with the internal cold-junction reference (±1°C (max) from 0°C to +60°C and ±1.5°C (max) from –40°C to+125°C) digital control on temperature sensor to find the desired field temperature. The TMP007 has non-volatile memory for storing standardization coefficients. The TMP007 is designed with mobility and low power supply (2.5V to 5.5V). The TMP007 is compatible with I2C and SM Bus. The size of TMP007 is 1.9-mm × 1.9-mm × 0.625-mm

Humidity Sensor (HDC1010): The HDC1010 digital humidity sensor is used and it provides accurate measurement of moisture level in environment at low power. It has excellent stability at high humidity. WLCSP (Wafer Level Chip Scale Package) simplifies board design. The HDC1010 is more robust against dirt, dust, and other environmental impurities. The HDC1010 has non-volatile memory for storing standardization coefficients. The HDC1010 is compatible with I2C.

Power supply: Here full bridge converter, phase shifted, 600-W high-efficiency power supply is used. It converts a 370 V to 410-V DC input in to a regulated 12-V output. To achieve high efficiency, the UCC28950 was used to drive synchronous rectifiers on the secondary side of the full bridge converter. The UCC28950 operates in burst mode. The DCM (Discontinues Current Mode) function is to improve no-load efficiency and to meet Green- Mode Requirements. The DCM comparator was intended to turn off the synchronous rectifiers at critical conduction in lighter loads (< 20%).

V. CONCLUSION AND FUTURE WORK

'Internet of Things' is far and wide castoff in relating devices and gathering statistics. This agriculture monitoring system serves as a reliable and efficient system and corrective action can be taken. Wireless monitoring of field reduces the human power and it also allows user to see accurate changes in crop yield. It is cheaper in cost and consumes less power. The smart agriculture system has been designed and synthesized. The developed system is more efficient and beneficial for farmers. It gives the information about the temperature, humidity of the air in agricultural field through MMS to the farmer, if it fallout from optimal range. The system can be used in green house and temperature dependant plants. The application of such system in the field can definitely help to advance the harvest of the crops and global production. In future this system can be improved by adding several modern techniques like irrigation method, solar power source usage

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