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Review on Real Time Approach for Smart Agriculture Based on IoT and Raspberry Pi 3

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Abstract—Smart agriculture is taking over traditional farming due to the evolution of the IoT (Internet of Things). Automatic irrigation systems as well as monitoring of environmental parameters are the key factor of proposed system. In this project, we have proposed Real time approach for smart agriculture based on IoT and Raspberry pi 3. For monitoring environmental parameters proposed system have used different sensors like soil moisture sensor, thermistor, DHT11 sensor, Gas sensor. These sensors are connected to ESP8266MOD through MCP3204.Proposed systems have used four nodes at four different farm fields which communicates with Raspberry pi 3 over Wi-Fi. Data from all sensors of all nodes is shown on webpage. Also if any sensor value exceeds threshold level, email alert is sent. If the soil moisture sensor of any node exceeds threshold value motor will be automatically OFF. Using past environmental data of all fields farmers can take better decision for future farming like which crop has to be planted at which period and at which field.

Keywords- Smart agriculture, Internet of Things, soil moisture sensor, environmental parameters.

I.INTRODUCTION

Internet of Things represents a general construct for the power of network devices to sense and collect information from completely different sources and sharing procured data across the net for process wherever it's used for numerous functions. This refers to industrial applications of technology to producing. But IoT is not limited to industrial applications. Now days IoT has become a talk of every desk. It has changed the perception of internet to IoT. Implementation of IoT based devices makes use of hardware and software components. Interface with the physical world is done using dedicated hardware components. Microcontrollers are used to execute software that interprets inputs and controls the system. IoT devices often use an OS supporting the interaction between the software and the microcontroller. Every field, that is health, environment, home, industries and entertainment is embracing the Internet of Things revolution. Agriculture has seen several transformations and has adopted many machines to extend the yield. In recent years, there are several technological advancements in farming which have led to rise in productivity and immunity of crops. About seventieth of the water out there within the world is consumed by the agriculture sector; with the assistance of soil moisture sensor planned system will optimize the irrigation method and use of water. The technology that plays a key role during this is that the Internet of Things. Smart agriculture is taking over traditional farming due to the evolution of the IoT (Internet of Things). The IoT networks are reducing human labour necessities by observance crop health and field surroundings remotely. IoT uses a wireless sensor network because the backbone for gathering information for these monitoring and management applications. The monitoring-system consists of end devices equipped with a range of sensors to observe numerous parameters like temperature, humidity, radiation, soil wetness, etc. and is capable of human action this knowledge to the opposite devices. IoT helps the farmers by watching growth stages of the crop, diseases, and estimation of the yield by giving otherwise restricted low-power, affordable devices access to bigger process capabilities via the net.

II.RELATED WORK

Before IoT technology, agriculture based applications has been dependent on embedded system. Where have to use embedded system based agricultural field monitoring design that develop and implement the use of different sensors embedded to an AVR microcontroller. The sensors incorporated are temperature, soil moisture and rain detector sensors. Based on the condition of the soil sensed by soil moisture sensor and the condition of rain, it turns ON/OFF the pump for supply of water to the field. LCD is used to display the condition of field provided by the various sensors. The sensors which are placed in the field provide us with the data in regard to the field which is then controlled and monitored by programmable controller. Currently system have to switch from embedded to IoT as, the use of wireless sensing element network that collect information from completely different sensors deployed at numerous nodes and send it through the wireless protocol. The collected information gives the data regarding the varied environmental factors. Monitoring the environmental factors isn't the entire answer to extend the yield of crops. There are many different factors which decreases the crop productivity. Hence, automation should be enforced in agriculture to beat these issues. In order to provide answer to such problems, it's necessary to develop integrated system that wills improve productivity in every stage. Hence, proposed system deals about developing smart agriculture using IoT.

As compare to embedded system, the IoT is beneficial in following points:

• Internet of things are computer hardware, software and networking capabilities that are embedded into everyday things.

• Less human labour requires.

• Consumes less energy.

• The problems faced by the traditional instrumentation based on discrete and wired method has been solved through the implementation of wireless method which provides with a low-cost wireless controlled irrigation solution and a real-time monitoring of the field.

• Consumes less time

• Allows the farmer to carry out his agricultural activities more efficiently.

Sr. No	Title	Technologies	Advantages	Limitations
1	Research directions for the Internet of Things, John A. Stankovic, 2014.	Internet of Things. Mobile Computing. Pervasive Computing. Wireless Sensor Network. Cyber Physical System. Machine learning	Massive scaling architecture, big data is explained. Architecture and dependencies. Creating knowledge and big data. Robustness. Openness. Security. Privacy and humans in the loop.	Not practical oriented only theoretically approach.
2	Network based fire detection system via controller area network for smart home automation, Kyunf chang lee, Hong hee lee, 2014.	Control Area Network. Internet of Things. Gateway.	Response time is very small in microsecond (10-100us).	A weakness to noise of various form including impulses or short circuit and a lack of awareness of the actual location of a fire.
3	Environment monitoring system based on wireless sensor networks using open source hardware, Venkatesh Neelapala, Dr. S. Malarvizhi, 2015.	Zigbee. Wireless sensor network. Arduino Uno. Raspberry pi. Apache server. MySQL database.	Monitor wireless data. All hardware is open source. Open source software packages are available.	This system is compatible only FTP server. Need static IP address.
4	Internet of Things: A survey on enabling Technologies, Protocols and Applications, Ala Al-Fuqaha, Mohsen Guizani, Mehdi Mohammadi, Mohammed Aledhari, Moussa Ayyash, 2015.	RF-ID. Smart Sensor. Internet Protocols. Big data analytics. Message queue telemetry transport. Advance message queue protocol. Cloud Computing.	Addressing the IOT objects is important to differentiate between object ID and its address. IOT divided into Identity related services, information aggregation, collaboration aware services and ubiquitous services.	For Message queue telemetry transport and Advance message queue protocols broker is third party.

		Domain Name Server.		
5	Evaluating publish/ subscribe approaches for use in tactical broadband, Trude H. Bloebaum, Frank T. Johsen, 2015.	Web services. Publish/Subscribe. Service oriented architecture.	Addressing performance of the MQTT, WS notifications, and AMQP protocols. Determined publish/ subscribe approach could use in the tactical broadband.	AMQP exhibited large delay due to poor networking connections and correspondingly high packet loss.
6	The implementation of smart electronic locking system based on Z wave and internet, Ching chuan wei, Yan ming chen, Chao chieh chang, chi han yu, 2015.	Z-wave. Raspberry pi. Domain name service. Remote control.	Low power consumption. No need of static IP address. It is wireless lock system.	Communication range of system is limited to local area network.
7	Green IOT Agriculture and Healthcare Applications (GAHA), Chandra Sukanya Nandyala, Haeng-Kon Kim, 2016.	Internet of Things. Cloud Computing. Sensor Cloud.	Users can easily access required sensory data from cloud anytime and anywhere if there is network. The sensor- Cloud infrastructure is a cost effective approach.	Broker is essential to execute this system.
8	Review on IOT Technologies, Govinda K, Saravanaguru R. A. K, 2016.	Internet of Things. RFID. Actuator. Wireless Sensor Network.	Core architecture of Internet of Things has been given. Users can easily access required sensory data from cloud anytime and anywhere if there is network. The sensor-Cloud infrastructure is a cost effective approach.	Not practical oriented.
9	RF based node location and mobility tracking in IOT, J. Ann Roseela, Dr. S. Ravi, Dr. M. Anand, 2016.	RF server. Received signal strength indicator. Wireless Sensor Network. Arduino Uno. Artificial Neural Network.	Proved by using mathematical model.	When IOT nodes going far away from RF server, then signal strength become weak, not able to achieve good communication due to interference. Given path of IOT node is static we cannot change once system install.
10	Challenges in IOT Networking via TCP/IP Architecture,Wentao Shang, Yingdi Yu, Ralph Droms, Lixia Zhang, 2016.	Internet of Things. TCP/IP. Network architecture.	The challenges of applying TCP/IP to IOT network that arise from the network and transport layers. Direction, how to use application layer protocols.	Not practical oriented only theoretically approach.
11	Smart city implementation model based on IOT technology, Jaehak Byun, Sooyeop Kim, Jaehun Sa, Sangphil Kim, Yong-Tae Shin, Jong Bae Kim, 2016.	Network Architecture. Wireless Senor Network. Internet of Things	It is automatic traffic system that's why less time consuming. Cashless transaction.	Practical oriented results not available.
12	Improving home automation security; Integrating device fingerprinting into smart home, 2016.	Identity management system. Fingerprint. JavaScript. Access control.	Dimming light intensity in absence of users in the vicinity. Smart lighting solution can significantly decrease energy costs of street lighting municipalities.	Number of client and devices (mobiles) are fixed.
13	IoT based monitoring system in Smart agriculture, Prathibha S	CC3200 single chip, Wi-Fi, NWP	It is smart agriculture system that's why less time consuming. No	This system is valid only in ideal

	R1, Anupama Hongal , Jyothi M ,2017		manual intervention.	conditions; practically result is not very good.
14	An Ingestion and analytics architecture for IOT applied to Smart city use cases, Paula Ta shma, Adanan Akbar, Guy Gerson, Guy Hadash, Francois Carrez, Klaus Moessner, 2017.	Big data. Complex event processing. Context aware. Energy management. Internet of things. Machine learning.	It allow data to be captured and ingested autonomously avoiding the human data entry bottleneck. System is flexible with respect to the choice of specific analysis algorithm. Support real time problems of transportation and energy management.	Message broker is essential.
15	Realisation of a smart plug device based on Wi-Fi technology for use in home automation systems, Sava jakovljev, Milos subotic, Istvan papp , 2017.	TCP/IP. Microcontroller. Star topology. Bluetooth. Message Queue Telemetry Transport.	Practically proved, communication time latency of Wi-Fi devices is less than Zigbee devices. High security and high data rate (11Mbps). Practical results are given based on response time.	Maximum 30 devices communicate at a time to system. Communication range is limited (10 to 30 meter).
16	Cost analysis of smart lighting solutions for smart cities, Giuseppe Cacciatore, Claudio Fiandrino, Dzymitry Kliazovich, Fabrizio Granelli, Pascal Bouvry, 2017	Heuristics. Internet of Things. Lampposts.	Dimming light intensity in absence of users in the vicinity. Smart lighting solution can significantly decrease energy costs of street lighting municipalities.	The street lighting solutions practically implanted in cities are not energy efficient.
17	Practical lessons from the deployment and management of a smart city Internet of Things infrastructure: The smart Santander tested case, Pablo Sotres, Juan Ramon Santana, Luis Sanchesz, Jorge Lanza, 2017.	Wireless Sensor Network. Near field communication. LORA Technology. Internet of Things.	It presents practical solution to the main challenges faced during the deployment and management of city scale IoT infrastructure. Addressing different functionalities within smart city: Security, Resource subsystem, Information subsystem.	The amount of information that can be sent to the air by battery- powered devices is not only limited by bandwidth, but is also limited by the battery capacity.
18	An IoT service oriented system for agriculture monitoring. Carlos cambra, Sandra sendra, 2017.	Wireless Sensor Network. Internet of Things.	Smart IoT communication system manager used as a low cost system controller.	Required bigger bandwidth .practically not easy.
19	IOT Based Smart Crop-Field Monitoring and Automation Irrigation System, R. Nageswara Rao, B.Sridhar, 2018.	Internet of Things, cloud computing, Irrigation system	A Raspberry Pi based automatic irrigation IOT system is proposed to modernization and improves productivity of the crop. The major advantage the system is implementing of Precision Agriculture (PA) with cloud computing, that will optimize the usage of water fertilizers while maximizing the yield of the crops and also will help in analysing the weather conditions of the field.	4G mobile is required.Somtimes range problem in some areas.

III.METHODOLOGY

The architecture of proposed system is shown in figure 1. Proposed system design a Real time approach for smart agriculture based on IoT and Raspberry pi 3.A four sensors are used those are DHT11, Soil moisture, Thermistor and MQ-6 sensor. There are four nodes each node having four sensors. Proposed system use ESP8266MOD and MCP3204 that interfaces between Raspberry pi three models B+ and every sensor. The above system is mainly divided in three section, Transmitter, receiver and communication mode. The transmitter which contain number of user. Internet is communication medium and Receiver is controlling devices. Transmitter mode includes 4 users through 4 different nodes. Receiver mode includes raspberry pi 3 which collectively gathered the information or data from all sensors and send it to webpage.

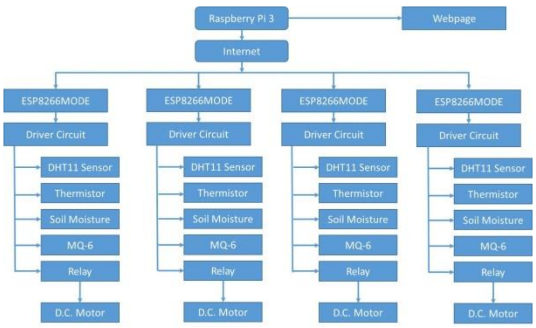

Figure.1. Block Diagram

The communication mode is internet here Wi-Fi is used through which all sensors data and information is shown on webpage. Also message will be send to registered email address when sensor achieve there threshold value. As shown in architecture proposed system 4 node at different field placed which includes ESP8266MOD,driver circuit ,DHT11 sensor, Thermistor, Soil moisture sensor, Gas sensor, relay and DC motor. These 4 nodes connected to Raspberry pi 3 through Wi-Fi. Raspberry pi 3 gathered all sensors data and transmits results on webpage.

Soil Moisture Sensor:

Soil moisture sensor used for testing wetness of soil. When the soil has water shortage, the module output is at high level. By victimization this sensing element one will mechanically water the flower plant, or the other plants requiring automatic watering technique. Module triple output mode, digital output is straight forward, analog output additional correct, serial output with actual readings.

Figure.2. Soil Moisture Sensor

DHT11 Sensor:

DHT11 Temperature wetness detector options a temperature humidity sensor advanced with a mark digital signal output. By exploitation the exclusive digital-signal acquisition technique, temperature and humidity sensing technology, it ensures high liableness and wonderful long stability. This sensing element includes a resistive-type humidity measuring element associated an NTC temperature measurement component, and connects to a high performance 8-bit microcontroller, giving glorious quality, quick response, anti-interference ability and cost-effectiveness.

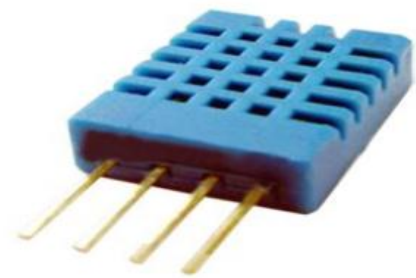

Figure.3 DHT11 sensor

ESP8266MOD:

The ESP8266 Wi-Fi Module could be a self-contained SOC with integrated TCP/IP protocol stack which will offer any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

Figure.4. ESP8266MOD

Each ESP8266 module comes pre-programmed with associate AT command set code, meaning, you'll be able to merely hook this up to your Arduino device and find concerning the maximum amount Wi-Fi ability as a Wi-Fi protect offers. The ESP8266 module is a particularly value effective board with a large, and ever growing, community. The integrated high speed cache helps to extend the system performance and optimize the system memory. Also, ESP8266EX is applied to any microcontroller style as a Wi-Fi device through SPI / SDIO or I2C / UART interfaces.

Relay:

It is an electronic component and acts as a switch. The principle of relay is based on right hand thumb rules. According to right hand thumb rule, folded finger indicate the direction of the magnetic field and thumb indicates the direction of current. The 5V Relay Module is utterly created for Arduino application. Relay having 3 pins, the VCC, GND and Signal. It will act as switch if the circuit and also the load circuit have completely different provide voltage. It ordinarily use if the load circuit is AC. it's a switch accustomed connect isolated affiliation from the circuit employing a circuit signals. it's red semiconductor diode that activates when the coil is energized or the signal pin features high input.

Figure.5. Relay

VI CONCLUSION AND FUTURE SCOPE

Proposed system design a Real time approach for smart agriculture based on IoT and Raspberry pi 3.A four sensors are used those are DHT11, Soil moisture, and Thermistor and MQ-6 sensor. There are four nodes each node having four sensors. Proposed system use ESP8266MOD and MCP3204 which interfaces between Raspberry pi 3 model B and all sensors. All observations and experimental tests proves that proposed system is a solution to field activities, irrigation problems, Implementation of such a system in the field of the crops and overall production. With the help of this approach the agricultural system completely automated also provides real time information about the field that will help farmers make right decisions. System send data or information from ESP8266MOD to Raspberry pi 3 by using Wi-Fi. Email is sent on a registered email address when threshold level is achieved by soil moisture sensor. We can use solar energy as power supply for future use.

REFERENCES

[1] John A. Stankovic, Life Fellow, "*Research direction for the Internet of Things*" IEEE, 2014.

[2] Kyunf chang lee, Hong hee lee, "*Network based fire detection system via controller area network for smart home automation*", IEEE, 2014.

[3] Venkatesh Neelapala, Dr. S. Malarvizhi, "*Environment monitoring system based on wireless sensor networks using open source hardware*", IEEE, 2015.

[4] Ala Al-Fuqaha, Mohsen Guizani, Mehdi Mohammadi, Mohammed Aledhari, Moussa Ayyash, "*Internet of Things: A survey on enabling Technologies, Protocols and Applications*", IEEE, 2015.

[5] C.Anton-Haro and M. Dohler, "Machine-to-Machine Communications: Architecture, Performance and Applications,"1st ed., Wood head Publishing Ltd. Jan. 2015.

[6] C. Pielli et al., "*Platforms and Protocols for the Internet of Things*," Endorsed Transactions on Internet of Things, vol. 15, no. 1, Oct. 2015.

[7] C.Zhu, V.Leung, L.Shu andE. C. H Ngai, "*Green Internet of Things for smart world*"IEEE, 2015, vol. 3, pp.2151-2162.

[8] F. Hu, D. Xie, and S. Shen, "*On the Application of the Internet of Things in the Field of Medical and Health Care*," in 2013 IEEE International Conference on Green Computing and Communications and IEEE Internet of Things and IEEE Cyber, Physical and Social Computing, pp. 2053–2058, IEEE, Aug. 2013.

[9] Jaehak Byun, "*Smart City Implementation Models Based on IoT Technology*", ASTL, 2016, vol.129, pp. 209-212.

[10] S.-Y. Lien, K.-C. Chen, and Y. Lin, "*Toward Ubiquitous Massive Accesses in 3GPP Machine-to-Machine Communications*,"IEEE Commun. Mag., vol. 49, no. 4, Apr.2011, pp. 6674.

[11] K. Zheng et al., "*The Analysis and Implementation of AllJoyn Based Thin Client Communication System with Heartbeat Function*,"Int'l. Conf. Cyberspace Technology, Nov. 2014, pp. 14.

[12] H. Cha, W. Lee, and J. Jeon, "Standardization Strategy for the Internet of Wearable Things,"Int'l. Conf. Information and Commun. Technology Convergence, Oct.2015, pp. 113842.

[13] G. Gardasevic et al., "On the Performance of LoWPAN through Experimentation,"Int'l. Wireless Commun. And Mobile Computing Conf., Aug. 2015, pp. 696701.

[14] IEEE St 802.15.4k-2013, "*IEEE Standard for Local and Metropolitan Area Networks Part 15.4: Low-Rate Wireless Personal Area Networks (LRWPANs) Amendment 5: Physical Layer Specifications for Low Energy, Critical Infrastructure Monitoring Networks*,"Aug.2013, pp. 1149.

[15] On-Ramp Wireless Inc., "*Light Monitoring System Using A Random Phase Multiple Access System*,"July 2013.

[16] A. J. Berni and W. Gregg, "*On the Utility of Chirp Modulation for Digital Signalling"*, IEEE Trans. Commun., vol.21, no. 6, June 1973 pp. 74851.

[17] ETSI, "*Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Short Range Devices (SRD); Radio Equipment to Be Used in the 25 MHz to 1 000 MHz Frequency Range With Power Levels Ranging Up to 500mW; Part 1: Technical Characteristics and Test Methods*,"tech. rep. EN 300 220-1 V2.4.1, Jan. 2012.

[18] LoRa Alliance, "*Lora WAN Specification*" V1.0, tech.rep, Jan. 2015.

[19] J. Manyika et al., "*The Internet of Things: Mapping the Value Beyond the Hype*,"McKinsey Global Institute, tech. rep., June 2015;

