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REVIEW ARTICLE

IOT BASED SMART SECURITY AND MONITORING DEVICES FOR AGRICULTURE

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ABSTRACT

A smart way of automating farming process can be called as Smart Agriculture. By implying an automated system it possible to eliminate threats to the crops by reducing the human intervention. The major emphasize will be on providing favorable atmosphere for plants. These agricultural automated systems will help in managing and maintain safe environment especially the agricultural areas. Environment real time monitoring is an important factor in smart farming. A Graphical User Interface based software will be provided to control the hardware system and the system will be entirely isolated environment, equipped with sensors like temperature sensor, humidity sensor. The controllers will be managed by a master station which will communicate with the human interactive software. The system will provide smart interface to the farmers. This smart system can increase the level of production than the current scenario. This system will realize smart solution for agriculture and efficiently solve the issues related to farmers. The environment will not be the barrier for production and growth of any plant and can overcome the problem of scarcity of farming production.

INTRODUCTION

IoT is an architecture that comprises specialized hardware boards, Software systems, web APIs, protocols which together creates a seamless environment which allows smart embedded devices to be connected to internet such that sensory data can be accessed and control system can be triggered over internet. Also devices could be connected to internet using various means like Wi-Fi, Ethernet and so on. Furthermore devices may not needed to be connected to internet independently. Rather a cluster of devices could be created (for example a sensor network) and the base station or the cluster head could be connected to internet. This leads to more abstract architecture for communication protocols which ranges from high level to low level. IoT are essentially embedded systems and smart objects connected to internet with unique IP address which can be discovered and communicated over internet. It is also seen that IoT devices may have external peripheral like Actuators and Sensors. IoT allows objects to be sensed or controlled remotely across existing network infrastructure, creating opportunities for more direct integration of the physical world into computer-based systems, and resulting in improved efficiency, accuracy and economic benefit in addition to reduced human intervention. When IoT is augmented with sensors and actuators, the technology becomes an instance of the more general class of cyber-physical systems, which also encompasses technologies such as smart grids, virtual power plants, smart homes, intelligent transportation and smart cities. IoT devices are divided into two braod categories: The wearable ones and Microcontroller/Microprocessor driven embedded IoT devices. Some of the Embedded devices like Arduino Lillypad can be used for further utilization to make your own wearable solution. But in wearable the hardware are pretty standard and IoT has only software scope for the developer. Developers can build apps for custom wearable devices like Peeble, Samsung Gear or can opt to create their own platform using Embedded solution and then can develop app for that platform.

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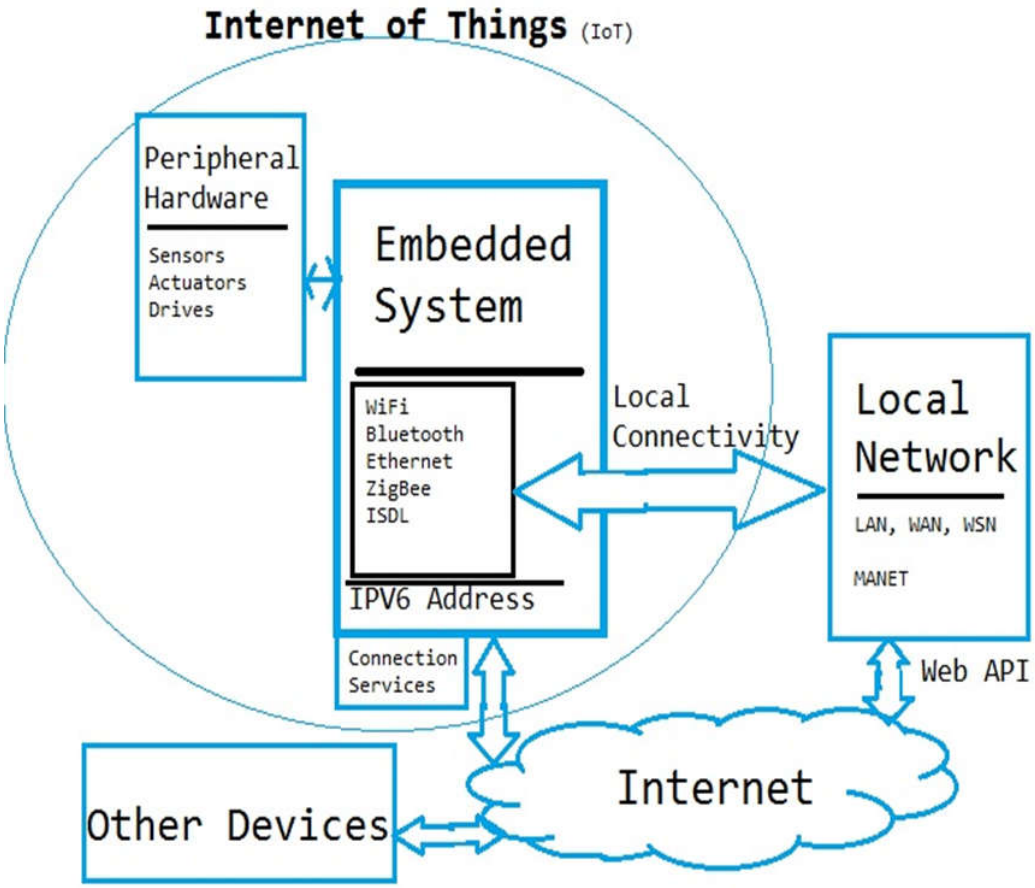
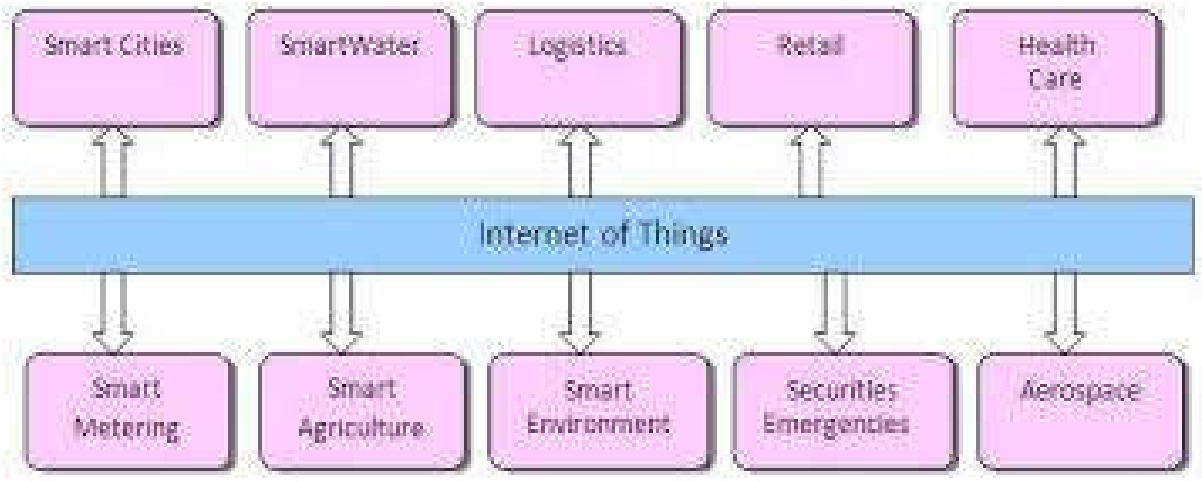
Common IOT Devices and Technologies

The Internet of Things provides interaction among the real/physical and the digital/virtual worlds. The physical entities have digital counterparts and virtual representation and things become context aware and they can sense, communicate, interact, exchange data, information and knowledge. Through the use of intelligent decision-making algorithms in software applications, appropriate rapid responses can be given to physical entity based on the very latest information collected about physical entities and consideration of patterns in the historical data, either for the same entity or for similar entities. These paves new dimension of IoT concept in the domains such as supply chain management, transportation and logistics, aerospace, and automotive, smart environments (homes, buildings, infrastructure), energy, defence, agriculture, retail and more.



Internet of Things (IoT) basic Architecture



Applications of IoT

The Applications of the IoT are numerous and diversified in all areas of every-day life of people which broadly covers society, industries, and environment.IoT application scenarios were grouped into 14 domains, which are Transportation, Smart city, ifesty le, Retail, Agric

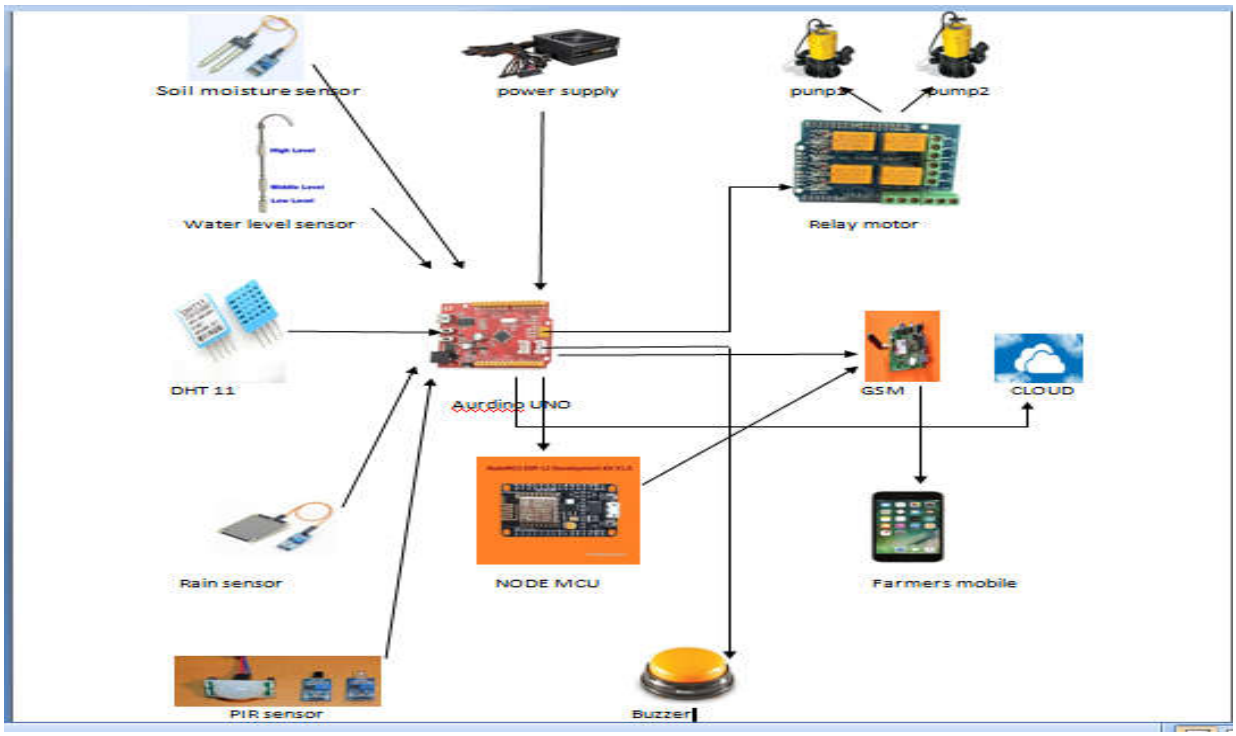
The Arduino and Node MCU study reviews the efficiency in smart agriculture. In paper "A Model for Smart Agriculture Using IoT", K. A. Patil, N. R. Kale (2016).As mentioned, the paper proposes a wise agricultural model in integration with ICT. ICT have always mattered in Agriculture domain. Over period, weather patterns and soil conditions and epidemics of pests and diseases changed, received updated information

allows the farmers to cope with and even benefit from these changes. It is really challenging task that needs to provide such knowledge because of highly localized nature of agriculture information specifically distinct conditions. The complete real-time and historical environment information helps to achieve efficient management and utilization of resources. The issue is that the technique can achieve convenient wireless connection within a short-distance. In paper "Automated Irrigation System Using a Wireless Sensor Network and GPRS Module", Joaquín Gutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibayand Miguel Ángel Porta-Gándara (2014). The paper aims at optimizing water use for agricultural crops. An algorithm was developed with threshold values of temperature and soil moisture that was programmed into a microcontroller-based gateway to control water quantity. The system was powered by photovoltaic panels and had a duplex communication link based on a cellular-Internet interface that allowed for data inspection and irrigation scheduling to be programmed through a web page. The issue isthat the investment in electric power supply would be expensive. In paper "An Effective Method for Crop Monitoring Using Wireless Sensor Network", N. Shakthipriya (2014). As mentioned, it reviews the state of art wireless sensor technology in agriculture.Based on the value of soil moisture sensor the water sprinkler works during the period of water scarcity. Once the field is sprinkled with adequate water, the water sprinkler is switched off. Hereby water can be conserved. Also the value of soil pH sensor is sent to the the farmer via SMS using GSM modem.The issue is that it provides only precision values that is not accurate and is not cost efficient . In paper "Automatic Control of Agricultural Pumps Based on Soil Moisture Sensing", Beza Negash Getu, Hussain A. Attia (2015).

It investigate the design and simulation of an electronic system for automatic controlling of water pumps that are used for agricultural fields or plant watering based on the level of soil moisture sensing. The speed of the motor is varied according to the level of the soil moisture content; the motor is OFF during maximum wet and is running with HIGH speed during dry soil conditions respectively. The duration of water pumping is controlled by a timer circuit. The system is tested using NI MULTISM simulation software.DIAC and TRIAC techniques are used.The issue is that it does not support several water levels and uses old techniques. In paper "Real- Time Automation and Monitoring System for Modernized Agriculture",G. MeenaKumari, Dr. V .Vidya Devi (2014). The approach proposes technological development in Wireless Sensor Networks made it possible to use in monitoring and control of greenhouse parameter in precision agriculture.In the Field bus concept, the data transfer is mainly controlled by hybrid system(wired and wireless) to automate the system performance and throughput. Zig Beeprotocols based on IEEE 802.15.4 for wireless system are used. The atmospheric conditions are monitored and controlled online by using Ethernet IEEE 802.3. Partial Root Zone Drying Process is implemented to save water. Also Controller Area Network (CAN) and Hybrid networks are used. It uses traditional communication system is used. The future research can be focused on Optical communication System with wavelength routing networks and can also be implemented using advanced ARM Controllers and core processors and also in energy saving, data fusion and other directions. In paper "Smart Drip Irrigation System using Raspberry pi and Arduino", Nikhil Agrawal, Smita Singhal (2015). It proposes a design for home automation system using ready-to-use, cost effective and energy efficient devices including raspberry pi, arduino microcontrollers, xbee modules and relay boards. Use of these components results in overall cost effective, scalable and robust implementation of system. Use of these components results in overall cost effective, scalable and robust implementation of system. Drip irrigation system makes the efficient use of water and fertilizer. Freeduino flavor of arduino is used in this design. To start the drip irrigation system an email is sent to a defined account. The issue is that the failure of any particular part or device is not informed and has to be tested manually. Not efficient for large agricultural fields. In paper "Multidisciplinary Model for Smart Agriculture using Internet-of-Things (IoT), Sensors, Cloud-Computing, Mobile-Computing & Big-Data Analysis", HemlataChanne1, Sukhesh Kothari2, DipaliKadam3 (2015), it reviews the use of modernized techniques such as Internet-of-Things (IoT), Sensors, Cloud-Computing, Mobile Computing, Big-Data analysis in agricultural sector. Soil and environment properties are sensed and periodically sent to AgroCloud through IoT (Beagle Black Bone). Bigdata analysis on AgroCloud data is done for fertilizer requirements, best crop sequences analysis, total production, and current stock and market requirements. It is beneficial for increase in agricultural production and for cost control of Agro-products. The system does not include different soil nutrient sensors and does not produce accurate data.

System Model

Agriculture is considered as the basis of life for the human species as it is the main source of food grains and other raw materials. It plays vital role in the growth of country's economy. It also provides large ample employment opportunities to the people. Growth in agricultural sector is necessary for the development of economic condition of the country. Unfortunately, many farmers still use the traditional methods of farming which results in low yielding of crops and fruits. But wherever automation had been implemented and human beings had been replaced by automatic machineries, the yield has been improved. Issues concerning agriculture have been always hindering the development of the country. The only solution to this problem is smart agriculture by modernizing the current traditional methods of agriculture. Our paper therefore proposes a system which is useful in monitoring the field data as well as controlling the field operations which provides the flexibility. The paper aims at making agriculture smart using automation and IoT technologies. The highlighting features of this paper includes Node MCU and Arduino. The Soil Moisture Sensor uses capacitance to measure the water content of soil (by measuring the dielectric permittivity of the soil, which is a function of the water content). Simply the sensor is inserted into the soil to be tested, and the volumetric water content of the soil is reported in percent. Level sensors detect the level of liquids and other fluids and fluidized solids, including slurries, granular materials, and powders that exhibit an upper surface. DHT11 Temperature & Humidity Sensor features a temperature & humidity sensor complex with a calibrated digital signal output. By using the exclusive digital-signal-acquisition technique and temperature and humidity sensing



technology, it ensures high reliability and excellent long-term stability. A rain sensor or rain switch is a switching device activated by rainfall. There are two main applications for rain sensors. The first is a water conservation device connected to an automatic irrigation system that causes the system to shut down in the event of rainfall. The second is a device used to protect the interior of an automobile from rain and to support the automatic mode of windscreen wipers. The PIR sensor itself has two slots in it, each slot is made of a special material that is sensitive to IR. The lens used here is not really doing much and so we see that the two slots can 'see' out past some distance (basically the sensitivity of the sensor). When the sensor is idle, both slots detect the same amount of IR, the ambient amount radiated from the room or walls or outdoors. When a warm body like a human or animal passes by, it first intercepts one half of the PIR sensor, which causes a positive differential change between the two halves. When the warm body leaves the sensing area, the reverse happens, whereby the sensor generates a negative differential change. These change pulses are what is detected.

RESULTS AND DISCUSSION

Water being a precious resource must be utilized efficiently. Agriculture is one of those areas which consumes lot of water. Irrigation to the farm is a time consuming process and must be done on timely basis. As aimed, through this work an auto irrigation system measuring the moisture content, and the water level. Later harvesting the excess water from the cultivation field and recycled back to the tank. The developed system also alerts the farmer with buzzer when there is intruder (human/animal) into the farm. The Fig. 3 shows the experimental setup of the smart agro system using wireless sensor network. The temperature, humidity, soil moisture content, water level are monitored through handheld device like mobile and also intimate the intervention of human/anima ls into the farm which is shown in Fig.4 given below.

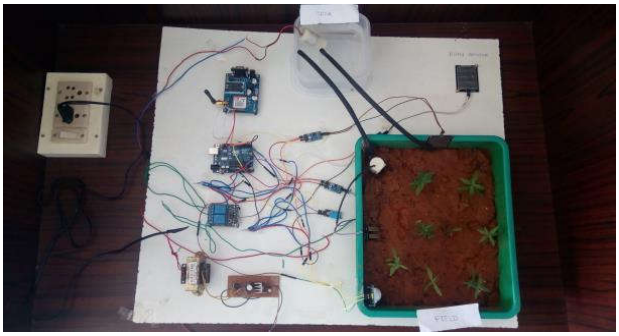


Figure 3. Experimental setup of the smart irrigation system

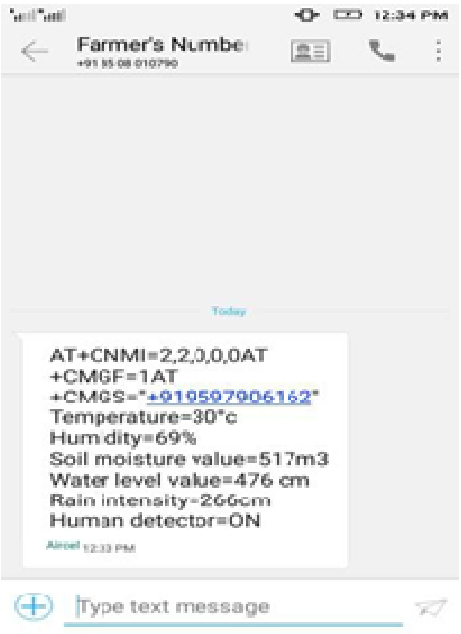


Figure 4. Output of the Smart Agro System using Wireless Sensor Network

Conclusion and Future Work

Water being a precious resource must be utilized efficiently. Agriculture is one of those areas which consumes lot of water. Irrigation to the farm is a time consuming process and must be done on timely basis. As aimed, through this work an auto irrigation system measuring the moisture content, humidity, temperature, rain detection and the water level. Later harvesting the excess water from the cultivation field and recycled back to the tank. The developed system also alerts the farmer with buzzer when there is intruder (human/animal) into the farm. Thus the proposed system deals about the irrigation system in smart way using Internet of Things (IoT) which solved the current problems related to farming such as by reducing human efforts, wastage of water and updating the farmer about the live condition of the field on the mobile device. The work can be extended in such a way it detects plant disease, crop theft, use of modernized technique.

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