IMPACT OF IOT ON AGRICULTURE IN INDIA

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Abstract-Farming industry will, perhaps, become more important than ever before in the next few decades. India needs to produce 60% more food in 2050 than it did in 2017 to feed the growing population. To meet this demand, farmers and agricultural companies will be forced to adopt more modern techniques of farming and monitor their produce. Issues concerning agriculture, rural farmers have always been hindering India's development due to lack of awareness of technologies. The only solution to these problems is agricultural modernization. However, India's agriculture is far from modernized.Technological modernization inIndian farming is nothing new. Handheld tools were the ideals hundreds of years ago, and then the Industrial Revolution brought about the mechanization of Cotton Spinning. The 1800s brought about the evolution of handling loose grain in bulk, chemical fertilizers, and the first petrol/diesel powered tractor. And finally moving to the late 1900s, when farmers started using satellites to plan their work. One such solution modernizing the Farming techniques all over the world is the Internet of Things.IoT is set to thrust the future of farming to the next level. Smart agriculture is already becoming very common among big farmers, and high-tech farming is quickly becoming the standard thanks to agricultural drones and sensors. This presentation/article we will try to outline IoT applications in agriculture and how "Internet of Things farming" will help farmers meet the world's food demands in the coming years with least investments.Key words: IoT, Sensors, agriculture

I Introduction

The traditional methods of farming mainly rely on natural resources and low labour costs. It's difficult and inefficient, and the workload is back breaking. Also it cannot meet the requirements of today's world. The requirements today is high-yield, high quality, efficient, safe and ecological. Moreover Indian agriculture is much affectedby the natural disasters like floods, etc. and climatic changes. This binds IoT to our agriculture methodologies, to meet the high demand. According to the latest census of the National Crime Bureau (NCRB) , 80% of Indian farmers who committed suicides across the country was due to debts and bankruptcy. The alarming situations of farmer's suicide and ignorance on the same, leads us to the development of this sophisticated system using the advancements in technology like IoT.More and more farmers must adopt to new technologies in order to obtain products with higher quality and more yield and less cost. The farmers have to transform from the traditional techniques to latest methodologies. This transformation mainly focuses on efficient utilization of resources, capabilities, use of techniques and protocols offered by IoT and applying them in the agricultural field.
Since the implementation of IOT (Internet of Things) technology to agriculture, the modernization of agricultural methods can be greatly improved.

Problem Statement

Agriculture is a labour intensive job and labour is expensive. However, most of the labour work/ hard work is only at the sowing season or in the harvesting season. In between the work is not intensive and mostly involves monitoring and small maintenance works like watering or Weed control etc.

This paper introduces the concept of IOT and summarizes the applications in the modern day agriculture for breeding, monitoring, crop growth, quality.

As seen in the Smart Home use case of IOT, More and more people are working on smart garden's in their home balconies or yards. This project puts forward a simple use case of smart garden that can later be scaled to a small/ large farm.

The productivity of plant growth is heavily influenced by the following factors

1. Change in environmental conditions like Heat, Humidity, Cold, Frost etc.
2. Water content in the soil
3. Solar radiation
4. Soil pH level
5. Rodent control

The above factors affect the quality and quantity of the produce. Crop monitoring can be carried out by gathering the present status of these parameters in the home garden and accordingly automate some of the processes like

1. Watering of Plants
2. Turning on the humidity control machine
3. Releasing the fertilizers when the pH balance is changing.
4. Motion sensing for Rodent control.
5. Opening/ Closing the blinds when the Solar radiation is too much/too less

6. Alerting the owner to prune the branches when there is too much foliage.

There are many more such solutions available based on the need and problems in the smart garden.

Fig 1.

Sensors have had revolutionary changes to many segments of our day to day life and economy as a whole. We have used sensors in many use cases like Environment Monitoring, Automation in Transportation, Supply chain & Storage Solutions, manufacturing and business, asset management, health care industries, Smart Home, Construction etc.

IoT remains a key to unlocking the potential for a sustainable reality.Internet of Things (IoT) is an ecosystem of connected physical objects that are accessible through the internet. The 'thing' in IoT could be a person with a heart monitor or an automobile with built-in-sensors, i.e. objects that have been assigned an IP address and have the ability to collect and transfer data over a network without manual assistance or intervention. The embedded technology in the objects helps them to interact with internal states or the external

While agriculture practices mostly rely on the use of mechanization and optimum use of fertilizer /seeds for good quality and quantity of produce, there is surprisingly little in the published literature that demonstrates the long-term, practical capabilities of gathering information from farm monitoring devices running 24X7 in our fields.

We will provide a solution to collect continuous all day information of the Home Garden. This solution becomes more and more mature as days progress so that it can be used for improving the quality & quantity of produce.

In this paper, We provide several state of the art examples together with the design considerations like unobtrusiveness, scalability, energy efficiency, security and also provide a comprehensive analysis of the benefits and challenges of these systems.

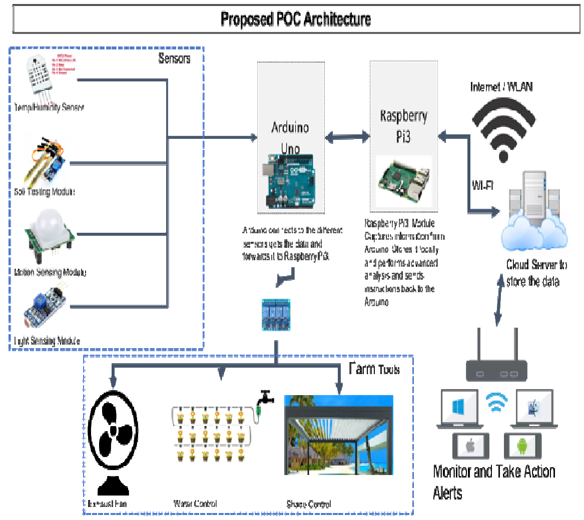

Fig 2. : Architecture.

II Solution & Architecture

The solution utilizes common open source technologies and easily available components in the initial phase. Figure 2 describes the architecture and connections of the different components. The solution comprises of the following components.

1) Raspberry Pi 3

Raspberry Pi® is an ARM based credit card sized SBC(Single Board Computer). The headlining feature of the Pi 3 is the built-in WiFi and Bluetooth apart from the processor and memory. The Pi 3 is our main source of processing the data provided by the sensors and is used as a full-fledged portable micro-computer. The Pi 3 is connected to a Wireless Network that may or may not be connected to the Server.

2) Arduino Uno

Arduino Uno is a microcontroller, simple computer that can run one program at a time, over and over again. It is used for simple repetitive tasks: reading sensor data, like temperature, Soil moisture, pH balance etc.

3) DHT-22 - Digital Relative Humidity&Temperature Sensor

The DHT-22 is a basic, low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin. Temperature is returned in C and humidity is a % value.

4) Soil Moisture Meter

The Soil Moisture Sensor is used to measure the volumetric water content of soil. A higher value indicates lower moisture in the soil. A lower value indicates that the water content in the soil is increased.

5) Hc-Sr501 Pyroelectric Infrared PIR Motion Sensor

Detector Module

This sensor is used for simple motion detection to ward of animals, birds etc.

6) Lm393 Optical Photosensitive LDR Light Sensor Module

Photosensitive resistor module is sensitive to environmental light intensity is generally used to detect the ambient brightness and light intensity. This is used to detect daylight and night.

7) 5VDC 4 Channel Relay 220V

The Relays are used to control the electrical components that run on normal 220V AC. E.g. – Fan to control the air flow or Opening/ Closing the blinds when the Solar radiation is too much/too less

8) Server System

The Server system is built using NodeJS and MongoDB to hold the data that is sent by the sensors. The server system will also process the data and generate reports for further analysis. The server system will also be used to analyse and perform actions automatically in the farm.

The architecture is modularized and can be added or removed based on requirements and enhancements.

Based on the availability of I/O ports on Arduino Uno board we can add any number of sensors. We can also add up to 4 Arduino Uno boards to the Raspberry PI 3 because of the 4 USB Ports we have on the PI 3.

III Conclusions and Future work

In this paper, we propose a system based on IoT technologies to approach the farming problem. This problem is very worrying among the farmers of India. Agricultural insurance is almost negligible and economic loss is becoming more noticeable, leading to suicidal deaths of farmers. Though there are several techniques/systems for modernized farming, those are not yet implemented in developing countries like India. One major factor being economy. This proposed system consists of the components that monitor weather, test soil, watering control system and data processing systems. Soil testing module helps farmer to identify the type of crop suitable for the soil. This architecture can be built with very nominal amount, thus in reach of poor farmers. One Time cost would approximately be around 5000 INR or 100 USD including software and components. The components are easily available in the market and are user replaceable. As future enhancements, we can incorporate more sensors to measure multiple other measurements. We could also incorporate new technologies like Artificial Intelligence for providing alerting mechanisms against anomaly detection. This proposal can be also be scaled up for farms from smart apartment garden to the fields, thus minimizing the need for continuous physical monitoring and helps the development of any vegetation, besides providing quality care.

B. AbbreviationsandAcronyms

CPU – Central Processing Unit

GPU – Graphical Processing Unit

I/O – Input / Output

INR – Indian Rupees

USD – United States Dollar

AC – Alternating Current

DC – Direct Current

LDR – Light Dependent Resistor

PIR - Passive infrared sensor

pH – Potential of Hydrogen

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