Usage of Internet of Things in Agriculture Automation

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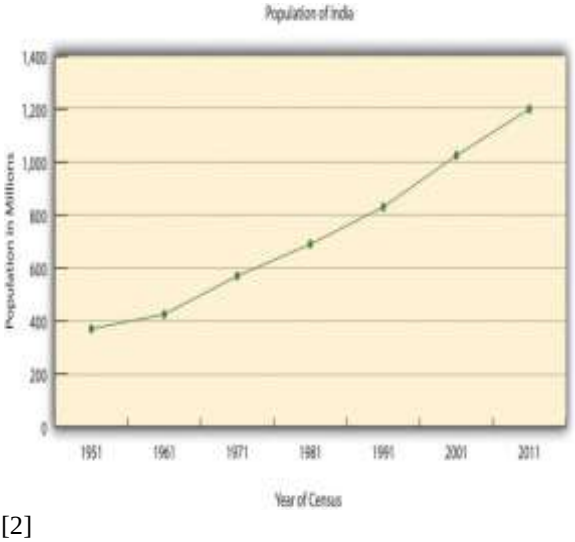
Abstract—*India's agricultural growth has not met to its requirements and demand and it is due to the inefficient practices as well as lack of technology resources that we are currently facing. So our idea is to solve this problem by using the Internet of Things so that the farmer can work on his specific task so that the extra burden could be reduced. Certain objectives are to minimize human efforts in the area of farming, to improve yield from harvest, to reduce the space used for harvest and to improve data recording methods to improve efficiency. The project involves Agricultural Automation by measuring the Soil moisture i.e. whether the soil is dry or wet so that the farmer can decide to use wet or dry crops according to the conditions, measuring Water level, automating irrigation system based on the soil moisture and water level , measuring Humidity, temperature and Dew point, Light control Automation for the purpose of conserving energy, Intruder Alarm using Infrared radiation and in the end finally sending the sensor output report to the farmer from the remote location or farmland using Notification System.*

Keywords-*Weather Monitoring, Soil Moisture, Irrigation Automation, Light Automation, Surveillance System.*

Introduction

The history of agriculture dates back thousands of years, and its development has been driven and defined by greatly different climates, cultures and technologies. Agriculture is the largest working sector in India and it occupies around 60% of it. The agricultural practices that have been implemented are currently outdated and they have hugely affected the production growth. India's per acre production growth is significantly poor when compared to other developed nations such as USA, China and Australia .It is due to the inefficient practices as well as lack of technology resources that we are currently facing .So our idea is to solve this problem by using the Internet of Things so that the farmer can work on his specific task and thus by improvising the technology and implementing it practically, comparatively better production growth can be expected. So the importance is laid on modernizing agricultural practices by using appropriate soil measurement techniques, weather monitoring, surveillance system, light automation and irrigation system. With the advent of Internet of Things, the area of Industrial automation is revolutionized and with its proper utilization in the field of agriculture, a focus can be laid on improving the production growth with cheaper resources and less man power.



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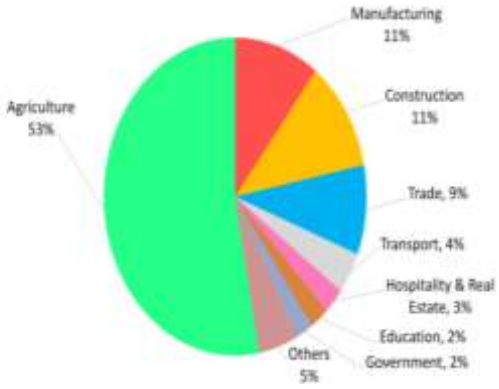

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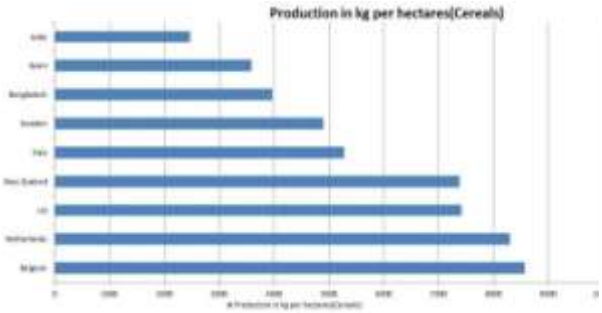
Literature Survey

India being the second most populous country in the world has 60 percent of its working sector under Agriculture. Even though majority of its working sector comes under Agriculture, it produces low yield per acre when compared to the other countries. Currently we have a world population of approximately 7.3 billion. In 2050, it is expected to grow up to 9.4 billion.

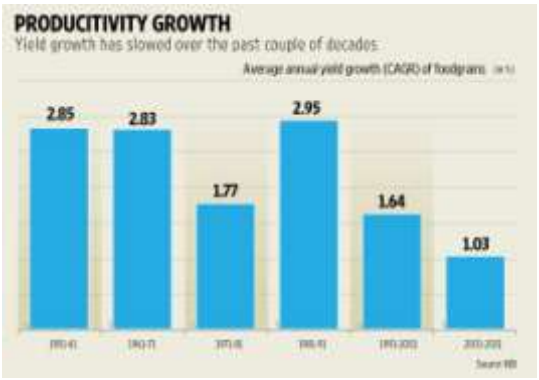
India on an average produces 3.1 tons per hectares of Rice. This on average is a very low yield compared to other nations such as China, Australia and USA. The economic contribution of agriculture to India's GDP is steadily declining with the nation's broad-based economic growth. Still, agriculture is demographically the largest economic sector and plays a significant role in the overall socio-economic fabric of India. India exported $39 billion worth of agricultural products in 2013, making it the seventh largest agricultural exporter worldwide and the sixth largest net exporter [1].



Literature Review

Some of the problems faced in the country:

- Labor shortage in the country
- Production cannot match population growth
- Land used for farming can be used more efficiently
- Data collection is problematic
- Low Acre per productivity in our Country



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PHYSICAL ARCHITECTURE

Weather Monitoring System

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The Weather Monitoring system includes measuring the following parameters:

1) Temperature
2) Humidity
3) Dew point
4) Heat Index

By obtaining these above parameters, the farmer can make decisions accordingly before growing the crops. Here we use Dht11 sensor to serve the purpose.

DHT11 uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin. By knowing the temperature and humidity, the farmer can consider these parameters while working in the farm.

Soil Moisture Monitoring System

Proper irrigation management produces high yield and hence high profit by using cheaper inputs. Soil moisture sensor measures the volumetric water content in soil. Soil moisture sensors measure the volumetric water content indirectly by using some other property of the soil, such as electrical resistance as a proxy for the moisture content. It can help you distinguish whether the soil is dry or humid. Moisture sensor has two probes to pass current through the soil. It then reads resistance in the soil. Less moisture in soil results in higher resistance which indicates that the soil is dry. More moisture in soil results in lesser resistance and which indicates that the soil is wet.

Serial No.	Range(in a scale of 100 units)		
	Soil Type	*Start Point*	*Final Point*
1	Wet Soil	~20	~80
2	Dry Soil	~80	~110

Water Supply Automation

A DC Motor is an electrical device which can push or rotate an object with great precision. In order to rotate an object at some specific angles or distance, DC motor is being used. Here the device is controlled by a feedback signal generated by comparing output signal and reference input signal. Water is supplied to the farm based on the soil moisture readings.

Basically it means that its angle of rotation is controlled by the duration of applied pulse to its Control Pin. The motor is made up of DC motor which is controlled by variable resistor and some gears.

Light Automation

- A **Light Dependent Resistor** (LDR) or a photo resistor is a device whose resistivity is a function of the incident electromagnetic radiation. Hence, they are light sensitive devices.
- They are also called as photo conductors, photo conductive cells or simply photocells.
- They are made up of semiconductor materials having high resistance.

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LDR works on the principle of Photo Conductivity in which the conductivity of the material is increased when light is absorbed by the material. LDR's are light dependent devices whose

resistance is decreased when light falls on them and that is increased in the dark. When a light dependent resistor is kept in dark, its resistance is very high.

In our Project, we actually reverse the principle such that during night, the lights are automatically switched on and during daytime they are turned off.

Advantages:

- Avoids excess energy consumption as the lights are automated
- No human intervention is required.

Motion Detection

Crops should be protected from damage. Usually animals enter the field and destroy the crops. Farmers are alerted about the intruders through PIR Sensors.

A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view. They are most often called as Motion Detectors.

All objects with a temperature above absolute zero emit heat energy in the form of radiation. The term *passive* in this instance refers to the fact that PIR devices do not generate or radiate any energy for detection purposes. Used as a Burglar alarm along with a buzzer, helps in detecting any physical intrusion to the farm. They work entirely by detecting the energy given off by other objects.
Thus the sensor doesn't consume a lot of power unlike a IR proximity Sensor.

Arduino IDE

The open-source Arduino Software (IDE) makes it easy to write code and upload it to the board. [6] It runs on Windows, Mac OS X, and Linux. Intel Galileo [7] combines Intel technology with support for Arduino ready-made hardware expansion cards (called "shields") and the Arduino software development environment and libraries. The development board runs an open source Linux operating system with the Arduino software libraries. Intel Galileo features the Intel Quark SoC X1000es.

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NODE RED

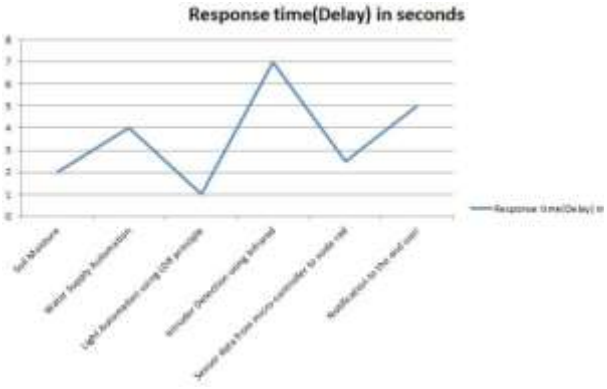
Node-RED is a tool for wiring together hardware devices, APIs and online services in new and interesting ways. [8] By creating flows, you can connect your Galileo board via Serial node as an input to the email and twitter API's. The output can be sent periodically in a specific time-interval where the sensor data will be notified to the PC/Mobile.

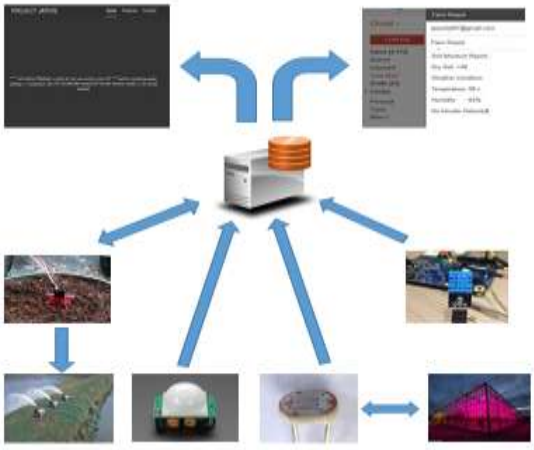
Project in a Nutshell

- The micro-controller is connected to various sensors.
- Dht11 sensor reads the Temperature, Humidity and Dew Point.
- The Soil Moisture measures the Water content in the soil and reports whether the soil is dry or humid as well as the water depth.
- The LDR sensor ensures that during night time the lights are automatically switched on/off and thus conserves energy without human interference.
- The PIR sensor works as a Burglar Alarm where during the night, any physical intervention to the farm land by humans or animals is detected and alarms the farm as well as sends Immediate report to the farmer.
- All the sensor readings are then periodically sent to the farmer from the remote location (farm-land) via Node-red to his Phone (Email/Twitter).
- This would benefit the farmer to monitor his farm land from any location.
- Depending on the soil moisture reading, suppose if the soil is too dry, then the

supply of water is automated to the farm with the help of Servo Motors.

Proposed outcomes and results





Node-Red Framework Workflow

Conclusion and Future Scope

The main agenda throughout our whole idea has been to modernize farming in India thus aligning India's aim towards building the Smart Cities and the Digital India initiative.
With the Agriculture Automation, the farmer can concentrate only on his specified role and the rest of the things will be taken care by the Internet of Things. Thus by using advanced technologies to the modern farming techniques, we believe that it can result in producing high yield per acre and solve some of the common issues that our farmers face and help them financially by reducing the manpower and at the same time producing high yield with limited area.

The future plans include analyzing the fertilizer contents in the soil and leveraging it into the maximum extent for better productivity .Use of Geo-spatial satellites in urban farming can also have a huge impact in the agriculture sector.

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