

IOT BASED SMART AGRICULTURE MONITORING SYSTEM

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Abstract—Due to population growth and demand for resources, water shortage is a major threat to agriculture. Determination of soil fertility also plays a vital role. Also, the major challenge lies in trapping the field animals such as Rats, Snakes etc. Hence this project proposes an innovative smart solution using “SMART AGRI App” which runs on IoT platform and addresses all the above-mentioned issues. The user has to feed the data about the land area and the type of crop planted in the app. With the given data we can calculate the amount of water, fertilizers, pesticides needed for the given land area. The Ethernet Shield is used to collect the data and transmit it to the SMART AGRI APP. The App provides the information about the soil fertility, humidity, water overflow, field animals. Using the water level sensor the water level in the tank can be calculated and based on the data from humidity and moisture sensor the land can be irrigated automatically and can detect the overflow in the water tank. Thus, smart irrigation system helps to improve the crop yield and thereby meet the demand. This project remotely measures and monitor water moisture levels in the soil to ensure that crops are getting optimal water resources and automatically trigger sprinkler systems to address low moisture levels in the soil to prevent crop damage or loss. This idea will improve the crop yield and manage them.

Keywords- Arduino Uno, IR sensor, Ethernet Shield, Gsm, Humidity and Moisture sensor, Motor driver.

I. INTRODUCTION

Sustainable agriculture is a measure of the endurance and sustenance of food grains produced in an eco-friendly manner. Sustainable agriculture helps in the encouragement of farming practices and approaches to help sustain farmers and resources. It is economically feasible and maintains soil quality, reduces soil degradation, saves water resources, improves land biodiversity, and ensures a natural and healthy environment. Sustainable agriculture plays a significant role in preserving natural resources, halting biodiversity loss, and reducing greenhouse gas emissions.

Sustainable agriculture farming is a method of preserving nature without compromising the future generation’s basic needs, whilst also improving the effectiveness of farming. The basic accomplishments of smart farming in terms of sustainable agriculture are crop rotation, the control of nutrient deficiency in crops, the control of pests and diseases, recycling, and water harvesting, leading to an overall safer environment. Living organisms depend on the nature of biodiversity, and are contaminated by waste emissions, the use of fertilizers and pesticides, degraded dead plants, etc. The emission of greenhouse gases affects plants, animals, humans, and the environment; hence, it necessitates a better environment for living things.

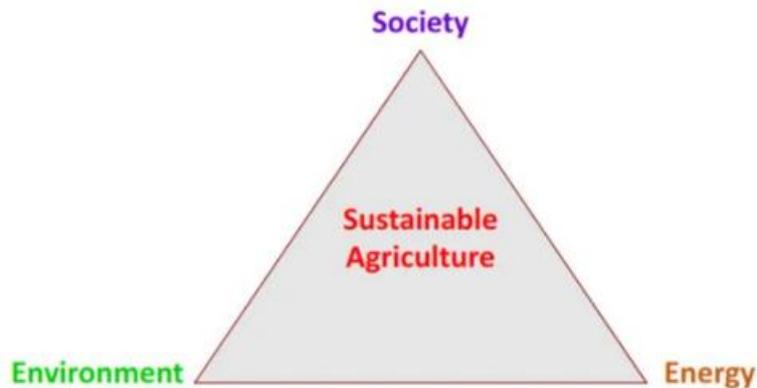


Figure 1. Factors of sustainable agriculture.

Agriculture is the largest contributor in India, with an 18% gross domestic product involving approximately 57% of people in rural areas. Over the years, although India’s total agronomic output has increased, the number of growers has fallen from 71.9% in 1951 to 45.1% in 2011. The Economic Survey 2018 revealed that the number of agricultural workers in the total workforce will drop to 25.7% in 2050. In rural areas, farming families gradually lose the next generation of farmers, overwhelmed by higher costs of cultivation, low per capita productivity, inadequate soil maintenance, and migrations to a non-farming or higher remunerative occupation. Presently, the world is on the verge of a digital revolution, and so it is the appropriate time to connect the agricultural landform with wireless technology to introduce and accommodate digital connectivity with farmers.

Regrettably, not all parts of the Earth’s surface are suitable for agriculture due to various restrictions, such as: soil quality, topography, temperature, climate, and most relevant cultivable areas are also not homogenous. Further, existing farming land is fragmented by political and fiscal features, and rapid urbanization, which consistently increases pressure on arable land availability. Recently, total agricultural land used for food production has declined. Furthermore, every crop field has different critical characteristics, such as soil type, flow of irrigation, presence of nutrients, and pest resistance, which are all measured separately both in quality and quantity regarding a specific crop. Both spatial and temporal differences are necessary for optimizing crop production in the same field by crop rotation and an annual crop growth development cycle.



Figure 2. Key issues of technology in the agriculture industry.

In most cases, variations in characteristics occur within a single crop, or the same crop is grown on the whole farm and requires site-specific analyses for optimum yield production. New technology-based approaches are needed to produce more from less land, and to address these various issues. In traditional farming practices, farmers frequently visit their fields throughout the crop’s life in routine farming activities to better understand the crop conditions. The current sensor and communication technologies offer an precise view of the field, from which farmers can detect ongoing field activities without being in the field in person. Wireless sensors monitor the crops with higher accuracy and detect issues at early stages, often facilitating the use of smart tools from initial sowing to the harvest of crops.

The timely use of sensors has made the entire farming operation smart and cost-effective, due to precise monitoring. The various autonomous harvesters, robotic weeders, and drones have sensors attached to collect data over short intervals. However, the vastness of agriculture puts extreme demands on technological solutions for sustainability with minimum ecological impact. Sensor technology through wireless communication helps farmers to know the various needs and requirements of crops without being in the fields, and they are then able to take remote action.

1.1 Smart Farming

Historically, ancient agriculture practices were related to the production of food in cultivated lands for the survival of humans and the breeding of animals, and was called the traditional agricultural era 1.0. This mainly resorted to using manpower and animals. Simple tools were used for farming activities, such as sickles and shovels. Work was mainly conducted through manual labor, and subsequently, productivity continued at a low level.

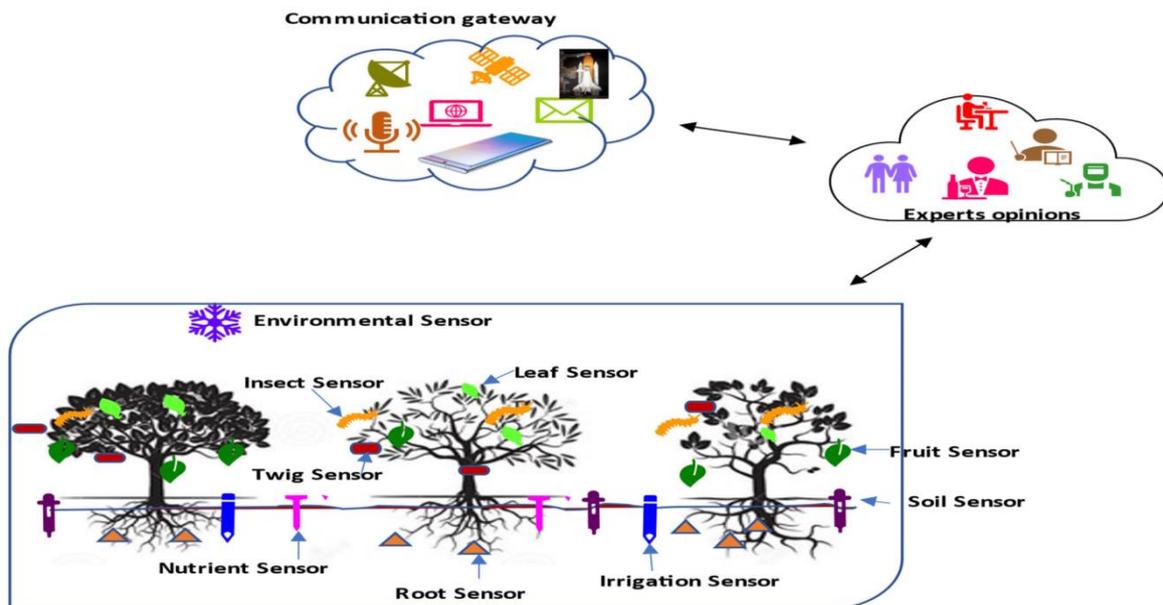


Figure 3. Agricultural decision support system framework.

During the 19th Century, new types of machinery appeared in the agricultural industries, in the form of steam engines. The wide use of agricultural machinery and abundant chemicals by farmers signaled the start of the agricultural era 2.0, and outwardly improved effectiveness and productivity of farmers and farms. However, considerably harmful implications, such as chemical pollution, environmental devastation, waste of natural resources, and excess utilization of energy, simultaneously developed.

The agricultural era 3.0 emerged during the 20th Century, due to the rapid growth of computation and electronics. Robotic techniques, programed agricultural machinery, and other technologies enhanced the agricultural processes efficiently. The issues that had arisen during agricultural era 2.0 were solved, and policies were readapted to the agricultural era 3.0 through work distribution, precise irrigation, the reduced use of chemicals, site-specific nutrient application, and efficient pest control technologies, etc.

The next agricultural era is also the current iteration of agriculture, the agricultural era 4.0, involving the engagement of recent technologies, such as the Internet of Things, big data analysis, artificial intelligence, cloud computing and remote sensing, etc. The adoption of new technologies has significantly improved agricultural activities by developing low-cost sensor and network platforms, aimed towards the optimization of production efficiency, along with reductions in the usage of water resources and energy with minimum environmental effects. Big data in smart farming provides extrapolative overviews of real-time agricultural situations, allowing farmers to make effective decisions. Real-time programming is developed with artificial intelligence concepts and embedded in IoT devices, helping farmers make the most suitable decisions. Smart farming promotes precision agriculture with modern, sophisticated technology and enables farmers to remotely monitor the plants. Smart farming helps agricultural processes, such as harvesting and crop yields, as the automation of sensors and machinery has made the farming workforce more efficient. The technologies convert traditional farming methods to automatic devices, causing a technological revolution in agriculture. Today, the technology in agriculture has altered the way farming is conducted, and conventional techniques have been transformed by the Internet of Things.

II. LITERATURE REVIEW

A) A Control System in an intelligent farming by using Arduino technology by Putjaika and Narayut (2016) Even now different developing countries using the traditional ways and backward techniques in agriculture sector. A little technological advancement has increased the production efficiency significantly. And to increase the productivity the inventive approach is introduced. Smart farming with Internet of Things (IoT) has been designed. By developing a motor vehicle which can be operated on both automatic and manual modes which can be used for various agriculture activities like cutting, spraying, and weeding etc. The controller will monitor the temperature, humidity, soil fertility, and water management to the field. By using green energy and smart technology the agriculture sector will find a better way to increase the productivity

B) Multidisciplinary Model for Smart Agriculture using IoT by Hemlata Channe, Sukhesh Kothari and Dipali Kadam (2015) Climate changes and rainfall has been regular over the past decade. Due to this, climate-smart methods called as smart agriculture is adopted by many Indian farmers. Smart agriculture is an automated and directed information technology implemented with the IoT (Internet of Things). IoT is developing rapidly and widely applied in all wireless environments. The sensor technology and wireless networks integration of IoT technology has been studied and review. A combined approach with internet and wireless communications, Remote Monitoring System (RMS) is done.

C) An Effective Method for Crop Monitoring Using Wireless Sensor Network by N. Shakthipriya (2014) In India about 70% of population depends upon farming and one third of the national capital comes from farming. The highlighting features of this concept includes smart GPS based remote controlled robot to perform tasks like weeding, spraying, moisture sensing, bird and animal scaring, keeping vigilance, weather forecasting, water management, canal controlling in both automatic and manual modes and all these data are stored and displayed in a mobile sensors, Wireless Fidelity etc.

D) Automatic Control of Agricultural Pumps based on Soil Moisture Sensing by Beza Negash Getu, Hussian A. Attia (2015) Water is always a needy part of everyone’s life. Due to environmental situation, water management and conservation will play a vital for human survivals. Recently, there were huge needs for consumer based humanitarian projects that could be rapidly developed using Internet of Things (IoT).This proposes an IoT based water monitoring system that measures water level in realtime . The prototypes are based on the level of the water can be an important parameter when it comes to the flood especially in disaster areas.

III. PROPOSED METHOD

Plants have had and still have a key role in the history of life on earth. They are responsible for presence of oxygen needed for human survival on this planet. At the same time agriculture is also important to human beings because it forms the basis for food security. It helps human beings grow the most ideal food crops and raise the right animals with accordance to environmental factors. Agriculture plays a vital role in India's economy. Over 58% of the rural households depend on agriculture as their principal means of livelihood. Agricultural export constitutes 10% of the country's exports. So the farmer's and even the nation's economy will be ruined if there are no proper yields due to lack of knowledge of the soil nature, timely unavailability of water. Thus the government should take steps for a better and profitable irrigation. It is a smart farming stick based on IOT (Internet of things) technology which has brought revolution to each and every field of common man’s life by making everything smart and intelligent. Aim of this project is to propose a novel smart IOT based agriculture stick assisting farmers in getting live data (soil moisture, humidity, water level) for efficient environment monitoring which will enable them to do smart farming and increase their overall yield and quality of products. The smart agriculture being proposed via this project is integrated with Arduino technology, mixed with various sensors and live data feed can be obtained online from mobile app.

In this paper, the user has to feed the data about the land area and the type of crop planted in the app. With the given data we can calculate the amount of water, fertilizers, pesticides needed for the given land area. The Wi-Fi module is used to collect the data and transmit it to the SMART AGRICULTURE APP. The App provides the information about the soil fertility, humidity, water overflow, field animals. Using the water level sensor the water level in the tank can be calculated and based on the data from humidity and moisture sensor the land can be irrigated automatically and can detect the overflow in the water tank. Thus, smart irrigation system helps to improve the crop yield and thereby meet the demand. This project remotely measure and monitor water moisture levels in the soil to ensure that crops are getting optimal water resources and automatically trigger sprinkler systems to address low moisture levels in the soil to prevent crop damage or loss. This idea will improve the crop yield and manage them.

IV. RESULTS



V. CONCLUSION

Smarter and more efficient crop production methodologies are needed to address the issues of shrinking arable land and the food demands of an increasing world population. There is a necessity for everyone to be aware of food security in terms of sustainable agriculture. The growth of new technologies for increasing crop yield and encouraging the adoption of farming by innovative young people as a legitimate profession. This paper emphasized the role of many technologies used for farming, particularly the IoT, in making agriculture smarter and more effective in meeting future requirements. The current challenges faced by the industry and future prospects are noted to guide scholars and engineers. Hence, every piece of farmland is important to enhance crop production by dealing with every inch of land using sustainable IoT-based sensors and communication technologies.

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