LITERATURE SURVEY

SMART FARMER – IoT ENABLE SMART FARMING APPLICATION

1) **A Survey on the Role of IoT in Agriculture for the Implementation of Smart Farming**

   Authors: Muhammad Shoaib Farooq, Shamyla Riaz, Adnan Abid, Kamran Abid, Muhammad Azhar Naeem

   Published: IEEE 2019

   Description: In this paper, authors have explained the aspects of technologies involved in the domain of IoT in agriculture. They explained about the major components and technologies, network architecture, network layers, network topologies and protocols involved in developing IoT based smart farming system .They also explained about the connection of IoT based agriculture systems with relevant technologies including cloud computing, big data storage and analytics and they highlighted the security issues.

2) **Internet of Things and LoRaWAN – Enabled Future Smart Farming**

   Authors: Bruno Citoni, Francesco Fioranelli, Muhammad A. Imran, Qammer H. Abbasi

   Published: IEEE 2019

   Description: In this paper authors have explained about LoRaWAN which is been under the spotlight in recent years due to its suitability to be the standard communication protocol for IoT deployments. It provides long communication range and low energy consumption by drastically reducing the available data rate. They also explained about the development of LoRaWAN enabled smart agriculture test to improve the understanding about the impact of the limitations using experimental test data, and

moving towards building predictive models and adaptive network management algorithms for smart farming using the data collected.

3) **A Systematic Review of IoT Solutions for Smart Farming:**

Authors: Emerson Navarro, Nuno Costa, and António Pereira
Published: MDPI 2020
Description: In this work, authors have presented a systematic review of the state-of-the-art of IoT adoption in smart agriculture and identified the main components and applicability of IoT solutions. In this particular work it was observed that the use of artificial intelligence and image processing techniques has become more common to improve the management of smart farming. From the identified applications of IoT for smart farming it was observed that the most common application is the monitoring of crops. Here, authors showed that different network protocols may be simultaneously used in IoT solutions for smart farming.

4) **IoT Enabled Smart Farming and Irrigation System:**

Authors: M. Rohith, R Sainivedhana, Dr. N. Sabiyath Fatima
Published: IEEE 2021
Description: In this paper, authors have demonstrated a IoT enabled smart farming and irrigation system to automate the process of watering to plants. This system helps to measure the values of various parameters such as humidity, moisture and temperature of plants and water them accordingly. This system consists of three sensors which will sense the values of humidity, moisture and temperature of plants. If any of the sensor values decreases the motor automatically turns on the water for plants. The ultimate

significance of the paper is that most of the manual work is reduced and watering process is automated with the help of IoT enabled devices as a result of which healthy plants can be grown.

5) **Traffic-Aware Secured Cooperative Framework for IoT-Based Smart Monitoring in Precision Agriculture**

Authors: Ibrahim Abunadi, Amjad Rehman, Khalid Haseeb, Lorena Parra, Jamie Lloret
Published: MDPI 2022
Description: This study proposes a framework for a system that combines fog computing with smart farming and effectively controls network traffic. Firstly, the proposed framework efficiently monitors redundant information and avoids the inefficient use of communication bandwidth. It also controls the number of re-transmissions in the case of malicious actions and efficiently utilizes the network's resources. Second, a trustworthy chain is built between agricultural sensors by utilizing the fog nodes to address security issues and increase reliability by preventing malicious communication. Through extensive simulation-based experiments, the proposed framework revealed an improved performance for energy efficiency, security, and network connectivity in comparison to other related works.

IoT SMART FARMING POLICIES AND SUCCESS STORIES

Many countries have understood the importance of IoT and facilitating through its advance monitoring techniques. Government of different countries is seizing the IoT opportunity and investing maximum to boost up the crop productivity. Adaptation of IoT technology in different countries has been discussed in this section.

1) AUSTRALIA

Government of Australia has invested AU$ 134 million to boost up farming. Due to this large investment a center was created by a private company in Sidney to implement IoT technologies for Smart farming . In 2014 an Innovative Network for Precision Agriculture System was established for the purpose of a collaborative frame work to create a national agenda in Australian agriculture. In terms of privacy and security, in 2015 an American farm Bureau took the lead in establishing a privacy and security set for farm data.

2) CHINA

In 2016 china launched its 13th five years plan to integrate IoT in the field of agriculture to enhance profitability . Project has been started in different eight provinces, with multiple products, technologies and 426 applications. Data was collected from multiple provincial and national level data centers. Moreover, NB-IoT App by Huawei company in china transforming the agriculture in a more efficient and an innovative way. NB-IoT provides low cost agriculture solutions as compare to cellular network where gateway implementation is not necessary. Huawei NB-IoT has large number of conections and wide coverage due to which it can resolve issue of scattered agricultural data.

3) MALAYSIA

Agricultural policy in Malaysia was established in two periods of time policy before and after independence 1948-1957 and 1957-2020 [158]. The purpose of the policy was to enhance the growth of crop and decrease the poverty. Multiple solutions have been created by Malaysian Institute of Microelectronic System (MIMOS) which are best for agriculture development. A sensor named Mi-MSCANT PH has been developed by MIMOS to gather environmental data. An agricultural framework has been developed by MIMOS to integrate IoT technologies which create a bonding between suppliers, traders, and agricultural producers mutually in unified manners. This framework utilizes technologies named Micro Electro Mechanical System (MEMS) and WSN which automatically collect environmental data

4) USA

USA has funded million Dollars to generate new agricultural technologies to fulfill the necessary requirements of energy and food. National Institute of Food and Agriculture worked on a project that is Internet-of-Ag-Things and develop sensing technologies for smart farming practices. The major purpose of this project is to develop precision technologies to enhance the efficiency of agriculture industries and make better use of water, fertilizers and organic food . The U.S. Department of Agriculture (USDA) has started a project to address water management challenges and develop new solution for those issues which are affecting agriculture. Technology experts are using USDA datasets to improve and design agricultural services .

5) INDIA

Smart farming has emerged to be the need of the hour for the Indian agriculture sector. It is much more efficient than the traditional methods of farming. Smart farming, which involves the application of sensors and automated irrigation practices, can help monitor agricultural land, temperature, soil moisture, etc. This would enable farmers to monitor crops from anywhere. Moreover, smart farming can help integrate digital and physical infrastructures which would benefit small farmers. The small and marginal farmers of India find it challenging to integrate digital and physical infrastructures which hampers their revenue growth. Agro-based start-ups can reach out to the farmers and help them gain access to such viable and cost-effective solutions. According to a report published by the National Association of Software and Services Companies (NASSCOM) in 2019, there were more than 450 argi-based tech driven start-ups in India as of 2019. This number has skyrocketed in the last two years as the sector witnessed a surge in investments and funding. Agri-based tech-driven start-ups have been very innovative in assisting farmers and revolutionising farming techniques. They have also addressed one of the most powerful headwinds (climate change) through climate-smart farming.

Climate-smartAgriculture

The rising population and changing diets have created a huge pressure on land in India. Farmers are struggling to keep up as crop yields level off, soil degradation rises, water shortage increases, biodiversity declines, and natural calamities become more frequent. Furthermore, agriculture accounts for almost 14% of India's total greenhouse gas emissions. Climate-smart agriculture (CSA) can help transform agri-food systems in a responsive manner and mitigate the devastating effects of climate changes while producing food and energy in a sustainable manner. Farmers in India are gradually realising the benefits of CSA. CSA is an integrated approach of managing cropland, livestock, forest, and fisheries. CSA also addresses the interconnected challenges of food security and rapid climate change. CSA can help India in achieving the following outcomes:

- **Enhanced productivity**: CSA can help in producing more food without compromising the quality which would promote nutrition security and boost growth in income among farmers, especially the poor and marginal groups.
- **Improved resilience**: CSA can reduce vulnerability to pests, drought diseases and climate-related shocks and risks. It can also help farmers nurture and develop the long stressed and unfavourable environment.
- **Reduced emissions**: One of the most important benefits of CSA is expected to be emission reduction. Automation leads to less labour-intensive activities which would help reduce emissions per calorie of food produced, prevent deforestation, and reduce emission of greenhouse gases such as carbon dioxide into the atmosphere. This will lead to a human power reduction from non-environment friendly sources.

India is slowly adapting to climate-smart techniques of farming which will help to change the environment of India and reduce greenhouses gases from agriculture practices. For instance, the farmers of Dhundi village in Gujarat have started using clean energy sources like solar power for irrigation. The solar power programme benefits farmers in two ways:

- Under the programme, farmers transfer electricity to the local grid; for this, they are provided incentives.
- Smart farming enables crop diversification which helps farmers reduce their dependence on monsoon for water.

GovernmentPartnerships

According to the Ministry of Agriculture, the government is taking various smart agriculture initiatives such as:

- **Crop yield prediction model using artificial intelligence (AI)**: In 2018, the National Institution for Transforming India (NITI Aayog) partnered with IBM for developing a crop yield prediction model using AI. This helps in providing real-time advisory to farmers.
- **AI sensors for smart farming**: The Indian government has partnered with Microsoft for empowering small-holder farmers in India. The partnership seeks to increase the income of the farmers through greater crop yield and superior price control using AI sensors. The partnership would help boost the adoption of AI in farming.
- **Drones for monitoring soil and crop health**: The government has launched a project, Sensor-based Smart Agriculture (SENSAGRI), involving six institutes. In this project, drones would be used for smooth scouting over land fields, for collecting precious information and transferring the data to farmers on a real-time basis. The project would be funded by institutes such as Ministry of Communication and Information Technology (MCIT), Department of Electronics and Information Technology (DEITY), Information Technology Research Academy (ITRA) and Indian Council of Agricultural Research (ICAR).

BUDGET

Budget 2022 focuses on smart and modern agricultural practices. According to the Prime Minister of India, agricultural loans have surged 2.5 times over the past seven years. These loans will help modernise agriculture significantly and enhance natural farming, with a prime focus on Agri-waste management. Furthermore, under the PM Kisan Samman Nidhi scheme, US$ 26.4 billion (Rs. 2,00,000 crore) has been disbursed to 11 crore farmers. Also, the government's efforts towards promoting the use of organic products have driven expansion in the organic products market to US$ 1.5 billion (Rs. 11,000 crore). The government is also providing financial support to Agri-tech startups and promoting the adoption of AI to revolutionise agricultural and farming trends.