

Radical Evolution 4.0 Agile Agriculture SPIS & Awareness using NLP with Emerging Hi-Tech

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Abstract

India must integrate two vital national objectives – food security and solar mission and its related awareness is the subpart of national aims. Using proper solar power, will helps the farmers to boost land fertility and its effectiveness. Because India is primarily an agro-based economy, co-locating solar with agriculture makes a lot of sense. It additionally permits India to link the government's aim of achieving 175 GW by 2022 with different farmer-centric targets like the multiplication of farmer financial rewards. High-yield agriculture will be developed between 2021 and 2025 and will try to advance and scale the development of the agricultural field with the internet of things, machine learning, and blockchain. Timely access to mandatory data and innovative service transformation is the key to profitability. The automatic watering system improves growing conditions, saves time and water, and is particularly useful in drought-prone areas. In the industrial sector, the production and consumption of agricultural commodities, plants, crops, and other basic needs are geographically diverse. A country's trading system is stimulated by agricultural production. This research paper aims to propose an application using emerging technologies and try to solve some basic challenges in their life.

Keywords- Indian Farmer, Mobile DAPP, Content, Embedded System, ETH Faucet.

1. Introduction

The Internet of Things involves multiple modifications, industrial movements, technological development, environmental design, and a practical and generous framework that includes everything. The IoT has the potential of approaching endless. Innovation form a dissimilarity in us occupied faster, living the era, and acquiring accepted control over our lives. The most reason for the web search out supply certain-period knowledge.[13] This research paper discussed machine learning, artificial intelligence, and its applications in agriculture, healthcare management, and social studies. Agriculturists can create the correct choice and established actual-opportunity knowledge among all phases of crops and time. Crops are the foremost crucial component in cultivation. Seeds of

plants are familiar with enormous-scale developments for nutrition production. Agriculture requires large quantities of water for irrigation and of good quality for the various production process. studied about rural development sub ah farms of Saharan region of Africa. It studied drip-driven irrigation systems for rural development of Sub-Saharan Africa.[51]. India is a global agricultural powerhouse. One of the most critical demands for agricultural growth is a comprehensive overhaul and consolidation of India's agricultural research and extension sector. Agriculture is India's Water and farmland are irrigated, resulting in the development of rural livelihoods. Through two national programs established in India over time, R&D in the field of agricultural technology has been conducted.

Food crops predominate[33] This paper gives the information about the supply chain and its benefits and its different kind of distribution processing, and farming products and it starts their journey from soil to the market Food crop cultivation, is a top focus for farmers, is found practically everywhere in the country. Agriculture in India has several challenges. 1. Long-standing problems and the merging issues from the preventing agricultural practices, system changing and 2. climate and economy. Different types of modern methods are available in the market and other countries for the farmer's development but due to less awareness the farmers do not apply in their sector [40] This research paper described a new and advanced way of RS using BC. It used a decentralized matrix completion form for collaborative filtering and a trust-based recommendation system. Awareness plays a very vital role in society as well as in the farming sector also. Any informative awareness related to the farming sector it helps to farmers to understand things from

multiple standpoints.[41] This research topic was discussed by 13 faculty researchers and experts. It described about IoT, smart contracts, and transaction records are very important for the agriculture fields. The data was collected through a questionnaire about the supply chain is very highly active in the agriculture sector. It described about IoT, smart contracts, and transaction records are very important for the agriculture fields. The data was collected through a questionnaire about the supply chain is very highly active in the agriculture sector. On social media platforms, misguiding people with worthless information is very common but it's too much harmful, etc. The aim of this research paper is proper supply of water to the crops using Wi-Fi communication and provide proper information related to the farming sector it helps them to adapt and connect to the new world of farming article provided them without any third-party access. They can use and access all data using mobile applications.

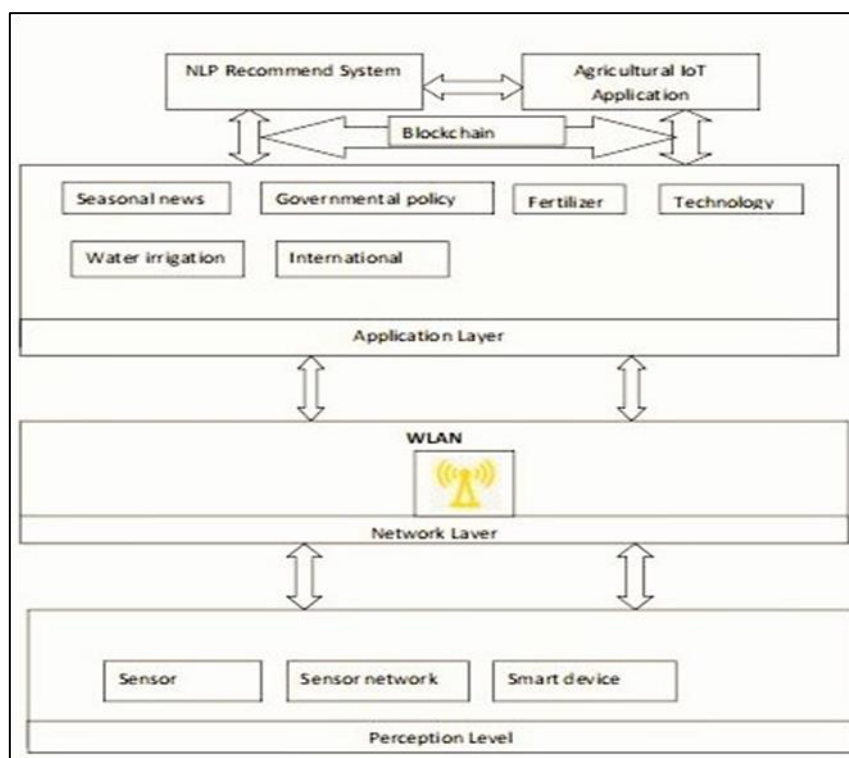


Fig1: Proposed System Architecture

This proposed system architecture has a 3 layer architecture. Each layer has its meaning and features which are connected. The first perception layer connects with multiple devices for the collection of information from the sensors and smart devices. The second layer is a network layer, it communicates with other networks for performing an assigned task by the user. The third layer interacts with each other. The NLP -based recommendation system and IoT application connect with the third layer the application layer. It interconnects with BC for security and transparency purposes.

2. Methods and Material

This research paper, highlight the farmer's daily issues and for solving purpose,

proposed an agriculture mobile application that is specially designed for farmers. In this proposed application there are 2 features 1. Automate SPI system 2. News recommendation system

1. Automate SPI system- Through these applications, the farmers monitor the water level of the plantation very effectively. In this proposed system set the value of moisture level for the plant at 60 or 40 as per the farmer's decision, the farmer has the authority to set the moisture level through node MCU wireless fidelity. This field communication occurs after the farmer set the value of the water level of the pump. Through this wireless network, the communication is established between the 2 modules as follows.

Table 1. Wi-Fi based field communications between two modules

Server Module	Led signals & its meaning	Client Module
Searching for Node MCU wireless fidelity pairing.	Blue Led blinking.	Pairing.
Communication Established	Blue Led glow.	Communication established.
Power on	Green Led glow.	Power on.
When the following conditions is occur in the field that time this communication messages send between two modules during operation are as follows		
Condition 1		Message 1
The soil moisture sensor is not jab into the field.	Red Led glow.	Device is not jab.
Condition 2		Message 2
The soil moisture sensor jab into the soil.	Off the red led light.	Soil is in good condition.
Condition 3		Message 3

The soil is dry.	Light green led glow Automated SPI system is activated.	Soil needs water.
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Table 2. Materials of two modules with its using purpose.

Sr. no	Material used in automated SPI system		Purpose of using in proposed system
	Server	Client	
1	Solar chargers module	Solar chargers module	It is used to store the photovoltaic energy. After the sunset it is use-able.
2	Solar panels 5Watt	Solar panels 5Watt	It helps to reduce the GHG in the environment, reduce the problem of electric shortage, Save money
3	NodeMcuESP8266	NodeMcuESP8266	It connect object easily it transfer the data using protocol
4	Batteries 2000mAH	Batteries 2000mAH	It is a rechargeable battery Its 3.7V .It is lithium ion polymer. It is useful for application.
5	Soil moisture sensor		It measures the estimate amount of water at location in the field. It helps to proper irrigate the plants .When the plant need water.

The 2nd proposed system is the news recommendation system using ML, secured by the smart contract.

The 3rd proposed system is a design of an agriculture app. By using this mobile application the smart contract provides security to the complete operations. This emerging proposed system workflow is as follows.

This recommendation system provides 2recommend news related to the 6 kinds of news which are all related to the farming sector for the security purpose it connects with smart contracts.

Step1: The admin panel has the authority to view and insert the news.

Step2: Then it transfers the news to the central server for storage purposes. If any new news is added by the admin panel.

Step3: Central server responds to the admin panel updating news and existing news stored successfully.

Step 4: Admin panel call the ml model to read the updated data, then the ML model check for any updated news from admin to CS. If it is yes then it will work and process on it.

Step 5: The CS sends the updated data to the ML model to process it

Step 6: ML sends the process data to the CS. Here, the central server store the raw news datasets input and processed data input.

Step7: Agriculture app sends the request for any updates to the central server.

Step 8: Central server sends updated news to the agriculture app which is added for the recommendation. This process will

happen when any news is updated by the admin otherwise it is always stable. Finally stored and deploy the news on the testing

network of eth faucet. It will protect from any third-party access.

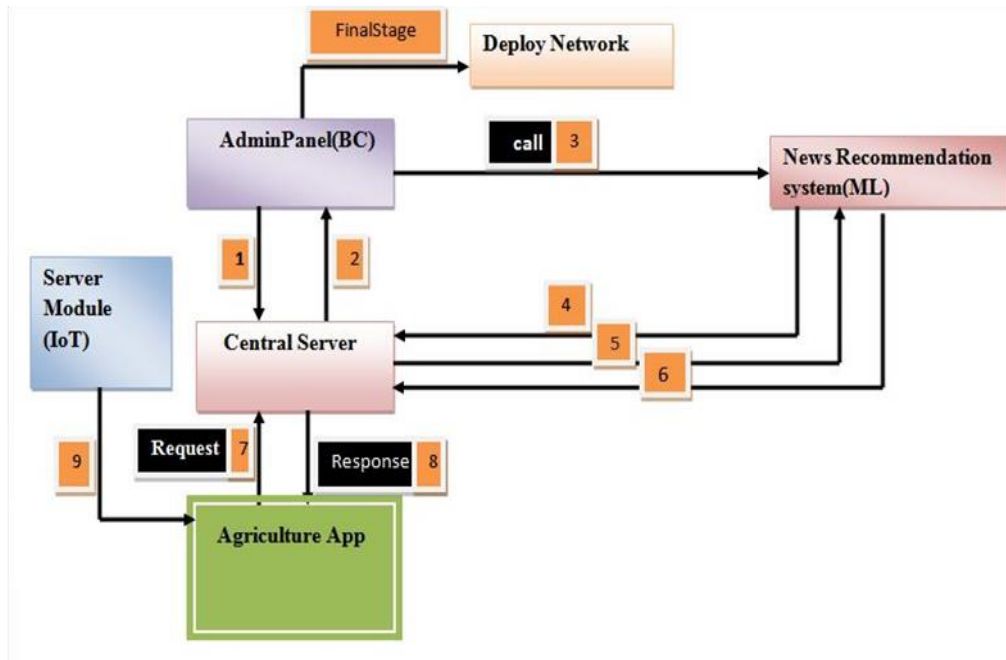


Fig2. Workflow of Emerging Proposed System.

3. Theory

There are multiples problem that occurs in the Indian agricultural sector are as follows,

1. Shortage of good qualities of seeds.
2. Shortage of modern equipment and machinery .
3. Less amount of fragmented landholding.
- 4 Facilities Shortage.
5. Unsatisfactory irrigation facility.

The main purpose of the internet of things in the agriculture sector is when the devices or things connect for communication without human intervention the job is done Here in this proposed system when the farmer's equipment connects without human

intervention and performs its job without manpower it quietly effective things for any farmers. The importance of an irrigation system is because of insufficient rainfall and, crops need water at every stage of growth for enhancing their productivity and yielding. [52] The researcher proposed that a cuckoo search algorithm has been developed although they do not take into account the characteristics of climate and they are used the thing-speak to display the sensing data which is collected by sensor hardware. In our proposed system first farmers acquire data from the sensor and perform an action through communication and it happens without human intervention when it connects with renewable energy, it provides more Wi-Fi communication between two modules based on this power. This system saves energy, reduces GHG, saves water supply management, saves extra money on manpower, and reduces.

```

server
#include <ESP8266WiFi.h>
#include "ESPAsyncWebServer.h"

#include <Wire.h>
#include <EEPROM.h>
// #include <Adafruit_Sensor.h>
// #include <Adafruit_BME280.h>

// Set your access point network credentials
const char* ssid = "NodeMcu";
const char* password = "123456789";
//double sm;

// Create AsyncWebServer object on port 80
AsyncWebServer server(80);
const char* PARAM_MESSAGE = "message";
String helloWorld(){
    return String("Hello World");
}
String readPres() {
    // int data1= analogRead(A0);
    // String data2=String(data1);
    String sm;

```

Fig3.1. Embedded coding of Server module

```

Client | Arduino 1.8.19
File Edit Sketch Tools Help
client
#include <ESP8266WiFi.h>
#include <ESP8266HTTPClient.h>
#include <WiFiClient.h>

#include <ESP8266WiFiMulti.h>
ESP8266WiFiMulti WiFiMulti;
const char* ssid = "NodeMcu";
const char* password = "123456789";
//Your IP address or domain name with URL path
const char* serverNameHello = "http://192.168.4.1/";
#include <Wire.h>
#define SCREEN_WIDTH 128 // OLED display width, in pixels
#define SCREEN_HEIGHT 64 // OLED display height, in pixels

// Declaration for an SSD1306 display connected to I2C (SDA, SCL pins)
#define OLED_RESET -1 // Reset pin # (or -1 if sharing Arduino reset pin)
//Adafruit_SSD1306 display(SCREEN_WIDTH, SCREEN_HEIGHT, &Wire, OLED_RESET);
String hello;
unsigned long previousMillis = 0;
const long interval = 5000;
void setup() {
    pinMode(LED_BUILTIN, OUTPUT);
    pinMode(D3, OUTPUT);

```

Fig3.2. Embedded coding of client module

A hybrid model is proposed that for the recommendation. It is based on Chi-square selection and soft-max regression. It uses tf-idf training datasets. they achieve the accuracy in their proposed system is 37%.[34] In our system used the unsupervised machine learning type with the concept of NLP. The main concept of NLP is to break down the words using the RAKE algorithm and find the similarity score of news using cosine similarity. In this content-based recommendation

system, farmers see them as per their choice and from all the set of news. As per his choice, the next 2 recommended based on news shows as per their article finding process. In the news recommendation purposed system, some important terms are used for performing during recommendation it is used are as follows

1. **NLTK** - It stands for natural language toolkit, imported from the python package. It analyzes the unstructured data.

2. **NLP** - It is a natural language processing. It is a powerful tool for prep process text data.

3. **RAKE**-Keyword extraction algorithm-It is a rapid automatic keyword extraction algorithm in NLP It includes in NLTK

4. **Cosine Similarity**-It is a method of normalizing document length during comparison. Text matching vector A and vector B.

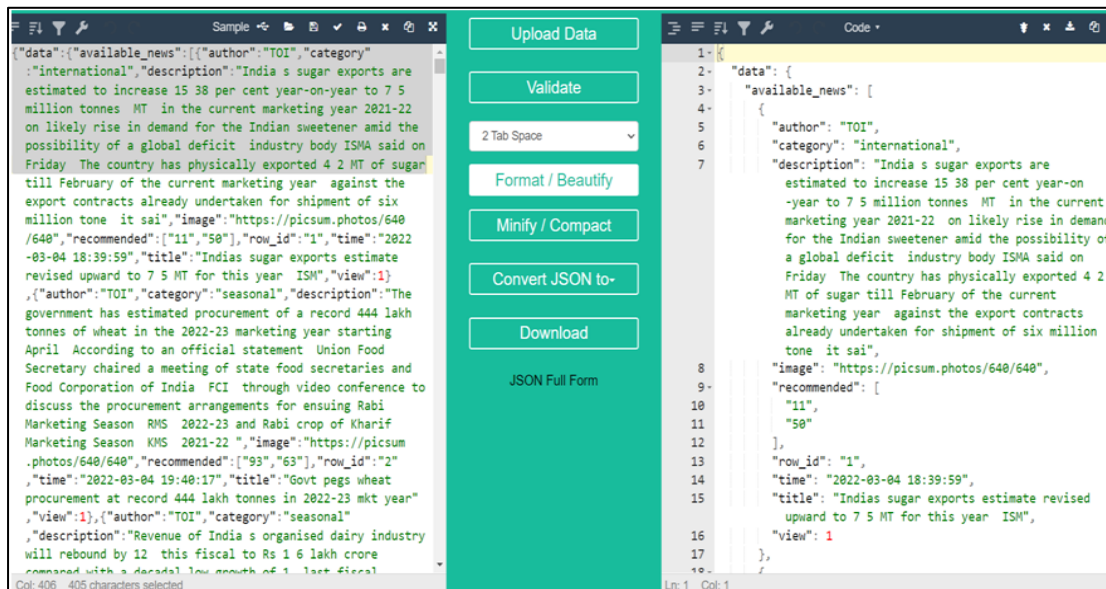


Fig 3.3.Code of NLP

Smart contract important term used for providing security This proposes mobile application is 20% DAPP. Making this DAPP application requires some BC important concepts are used as

1. **Meta Mask wallet**-It is also called HOT wallet. It works on safety and security. It suggests users open just one tab at a time when it is inactive. Wallet ID locked.

2. **Test network Faucet**- It is an ETH faucet developer tool to get ETH. It is helpful to prevent malicious users.

3. **ABI** - It uses as a standard way to interact with smart contracts. It is JSON data that EVM recognizes to know about the smart contract.



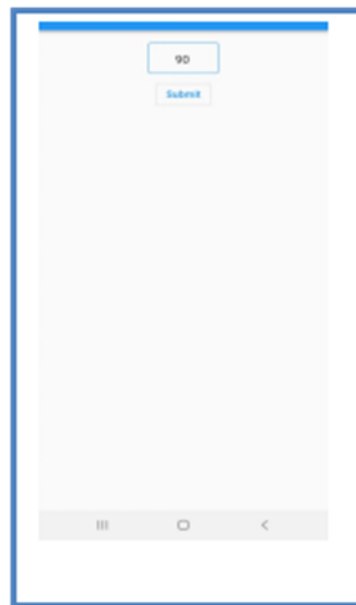
Fig3.4. Meta Mask wallet permission page.

4. Result

A DApp based mobile application is specially designed for farmers. The main aim is to solve some issues related to the agriculture sector. Using this application, we try to solve their two major problems irrigation-based and awakening awareness-

based. This research paper proposed an agriculture app for farmers.

Result 4.1 presents the set the soil moisture level of the water pump. Accordingly, automatically water flows toward the crops in the field.



Result Fig 4.1. Setting of Water level

Result 2 Shows that this proposed recommendation system provides multiple numbers of news available. As per the

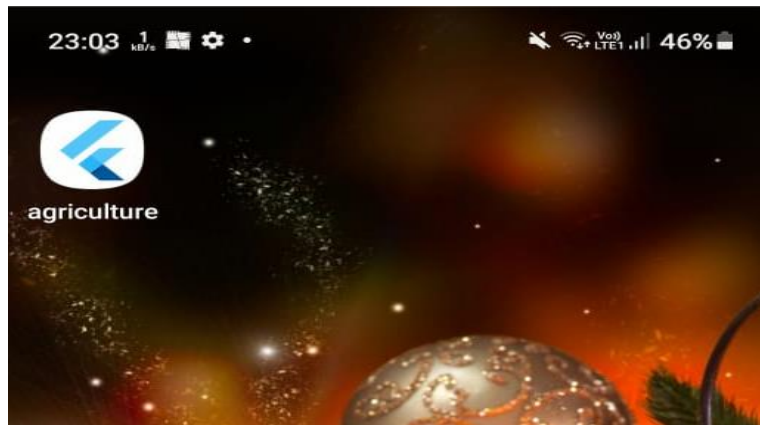
reading of the news article, that system recommends the two new related to this article.



Result Fig 4.2. News Recommendation syste

Result3. Presented the whole operation done by an agriculture app. It is 20%

DApp. It is a mobile application specially designed for Indian farmers.



Result Fig 4.3. Agriculture App

5. Discussion

The agriculture sector is the most common but very an important topic for research. Multiple researchers did the research in this field but still, but it is challenging. In this research, we found that this is a part of the 4.0 revolution because it has more challenges in this field. During the survey and discuss with multiple farmers to walk with multi news technology and some are afraid about the concept of adopting new in the survey we found that they were suffered from daily basics challenges like loss of water, crop failure and many more challenges which is the most common in every field. This proposed application tries to solve some challenges based on the research questions system it is a solar-powered based automated irrigation system and it automatically operates through the device. Proper supply water management help to reduce the help in enhancing their crop productivity. For adopting the new techniques and knowledge about the globe what is going on in the globe and how we can apply the multiple trends related to the farming like Israel country. For applying a technique like Israel country, the main objective is awareness for them, it is very essential for them News recommendation plays a role in awareness among the farmers. The small datasets are used here. Now it will show 2 recommendations for news show

the farmers. In the future, when a large number of datasets are used that it will show more amounts of recommendations like Netflix, and Amazon. This paper uses the BC smart contract for providing security, and transparency and to protect articles of news from third-party access. The following questionnaire asked while the survey, these are research discussion questions are as follows. It helps a lot in the implementation of the mobile application.

DQ1: What is the need for an internet of things in the agriculture sector?

DQ2: How many hours are wasted during monitoring the crop field water irrigation?

DQ3: How many farmers in India used internet of things farming techniques like Punjab?

DQ4: Which the governmental policies are too much beneficial for you?

DQ5: How do you know about the in-market launch of new devices related to farming?

DQ6: Do you want to grow like Israel and solve your sector problems using multiple technologies? Etc.

6. Conclusion

In revolution 4.0, we presented emerging technological benefits related to the farming sector for the farmers. When the adoption of the technology in this field, it will provide more benefits to the farmers.

In the future, many more features added in it to this app application like weather monitoring, fertilizer quantity checking, cattle health, crop growth health, etc which is beneficial to the environment as well as for farmers to save natural resources and enhance more. The awareness about the latest technologies and methods for obtaining more accuracy needs more amount data in the future it shows multiple news recommendations it is helpful to them in applying new methods in their fields. Emerging technological advancement will provide a new direction to the nation and provides awareness it will give a new perspective way of living.

References

- [1] Yun Xu (April 2015) IEEE , “Recent Machine learning Applications to Internet of Things”.
- [2] Nallapaneni Manoj Kumar ,Pradeep Kumar Mallick, (2018) Elsevier“Blockchain technology for security issues and Challenges”, International Conference On Computational Intelligence and Data Science.
- [3]Chandhini .K.(January 2016) “ A Literature Study on Agricultural Production system Using IoT as Inclusive Technology”, International Journal Of Innovative Technology and Research.
- [4] G. Sambasivam, Geoffrey Duncan Opiyo (2020) IEEE “A predictive machine learning application in agriculture: Cassava disease detection and classification with imbalanced dataset using convolutional neural networks”,Egyptian Informatics Journal.
- [5]Fran Casino, Thomas K. Dasaklis,Constantinos Patsakis , Elsevier (2019), “A Systematic literature review of blockchain-based applications: Current status”, Telematics and Informatics.
- [6]Jitin Jagannath,Nicholas Polosky,Anu Jagannath,Francesco Restuccia and Tommaso Melodia , (July2021) IEEE “Machine Learning for wireless Communications in the Internet of Things: A Comprehensive Survey”.Ad Hoc Networks.
- [7] Shaik Vaseem Akram,Praveen Kumar Malik,Rajesh Singh Anita Sudeep Tanwar, IEEE, (June 2019) “Adoption of blockchain Technology in various Realms: Opportunities and Challenges”.
- [8]Omar Said,Masud(2013) , “Towards Internet of things: Survey and Future Vision”,International Journal of computer networks(IJCN),Volume 5.issue(1):2013.
- [9]Fatima Hussein,Rashid Hussain,Sayed ali Hassan and Ekram Hossain(2018),”Machine Learning in IoT security: Current Solutions and Future Challenges”,International journal of Computer Network.
- [10] J.Artigas, A. Beltran, C.Jimenez , A. Baldi, R. Mas C. Dominguez,J.Alonso(2001) Elsevier, “Application of ion sensitive field effect transistor based sensors to soil analysis”, Computers and electronics in agriculture.
- [11]Sabir Hussain Awan, Sheeraz Ahmed,Sozan Sulaiman Maghdid,Khalid Zaman,M.Yousaf Ali Khan,Zeeshan Najam, Sohail Imran (2020) , “Blockchain with IoT, an emergent Routing Scheme for smart Agriculture” International Journal of Advanced Computer Science and Application, Vol. 11, No. 4.
- [12]David Christin Rose and Jason Chilvers,"Agriculture 4.0:Broadening Responsible Innovation in an Era of smart farming", (2018)frontiers in sustainable food systems.
- [13]Harikumar Pallathadka, Malik Mustafa, Domenic T. Sanchez, Guna Sekhar Sajja, Sanjeev Gour, Mohd Naved(2020) Elsevier, "Impact Of machine learning on Management, healthcare and agriculture.
- [14]Sudeep Tanwar,Quasim Wai- Chnag Hong(Senior member of IEEE) e.tl "machine learning adoption in

- blockchain based smart application:: challenges and the way forward " IEEE (2020).
- [15] Roy A.Islam W,Hasan SM,et.al,"Propects of of Solar pumping in the northern area of Bangaladesh(2005)American Journal of Renewable and sustainable Energy.
- [16] Shah T,Durga N,Verma S et.al,"Solar Power as Remunerative Crop,Water Policy Research Highlight"(2016)
- [17] VC Sontake,Kalamkar,"Solar photovoltaic water pumping system"(2016)
- [18] Woltering L,Pasternak"The Afican market garden: The development of low- pressure drip irrigartion system for smallholders in the sunado sahel"
- [19]Compana A,Rap,Li,et.al,"Economic Optimisation of photovoltatic water pumping system for irrigation."(2015)
- [20] Food and Agriculture Organization of the United Nations(FAO)2017.
- [21] F.Servida and E.Casey,"IoT forensic challenges and opportunities for digital traces",Digit.Invest.vol.28.pp.S22-S29.Apr.2019.
- [22]E.Casey,The chequered past and risky future of digital forensics,"Aust.j.Forensics Sci vol51,no.6.pp.649-664,2019.
- [23]F.Al-Turjman and A.Malekloo,"Smart parking in IoT-enabled cities:A survey",Sustain Cities Soc.vol.49,May 2019,Art no.101608.
- [24] H.Chi,T.Aderibigbe,andB.C..Granvill e,"A framework for IoT data acquisition and forensics analysis,"in proc.IEEE int.Conf.Big Data,2019,pp.5142-5146.
- [25] M.M.Losavio,K.P..Chow,A.Koltay, and J.James,"The Internet of things and the smart city:Legal challenges with digital forensics,privacy and security",Security Privacy,vol.1,no.3,p.e23,2018.
- [26]W.Ejaz and A.Anpalagan,BlockchainTechnology for security and privacy in internet of things.Cham,Switzerland:Springer,2019,pp.47-55.
- [27] O.Yakubu,O.Adjei, and N.Babu,A review of prospects and challenges of Internet of Things",Int.J.Comput.Appl,vol.139, no.10,pp.33-39,2016.
- [28] S.O Shaughnessy and A.Keane,"Impact of cloud computing on digital forensic investigations",in proc.IFIP Adv.Inf.Commun.Technol.,vol.410,2013,pp.291-303.
- [29]E.Oriwoh and G.Williams,"Internet of Things:The arguments for smart forensics",in Handbook of Research on digital crime,vol.42.Hershey,PA,USA:IGI Glob.2014,pp.pp.1-8.
- [30]J.Deogirikar and A.Vidhate,"Security attacks in IoT: A survey",in Proc.Int.Conf.IoT Soc.Mobile Anal.Cloud(1-SMAC),2017,pp.32-37.
- [31] Shaina Raza,ChenDing,"News recommender system:a review of recent progress challenges,and opportunities", (2021),Springer.

- [32]Joeran Beel, Bela Gipp,Stefan Langer, Corinna Breitingner,"Research paper recommend systems a literature survey", (2016).
- [33]Giovanni Mirabelli, Vittorio Solina, "Blockchain and Agricultural supply chain traceability: research trends and future challenges", (2019), Elsevier.
- [34] Donghui Wang, Yanchun Liang, Dong Xu, Xiayue Feng, Renchu Guan, "A content-based recommender system for computer science publication", (2018) Elsevier.
- [35] Weiwei Shao, Mingming Zhu, Jiahong Liu, Baishaweng, Chenyao Xiang, Jiagong Gong, Ning Wang, Guiyu Yang, "Photovoltaic Water Lifting and Ecological Water Supplement for Xiang an Water System in Xiamen City", (2017), Elsevier.
- [36]Xichen Wang, Chen Gao, Jingtao Ding, Yong Li and Dep Jin CMBPR: Categor Aided Multi-Channel Bayesian Personalized ranking for Short Video Recommendation", (2019), IEEE.
- [37] Pengtao Lv, Xiangwu Meng, Yujie Zhang, "BoRe: adapting to reader consumption behaviour instability for news recommendation", ACM (2019).
- [38] P.G.Pardey, J.M.Alston, "Investments in and the Economic Returns to Agricultural and Food R&D Worldwide", (2014), Elsevier.
- [39]Sebastian Sadowski, Peros Spachos, "Solar-Powered Smart Agricultural Monitoring System Using Internet of Things Devices", (2018), IEEE.
- [40]Dariel Bobadila, Carlo Lipizzi, "A Blockchain-Based Collaborative Filtering Recommendation System Based on Trust", (2021) IEEE.
- [41]Mohammad Hossein Ronaghi, "A Blockchain blockchain maturity mode agricultural supply chain", (2021), Elsevier.
- [42]Daniel Macrinici, Cristian Catofeanu, Shang Gao, "Smart contract application within blockchain technology: A systematic mapping study", (2018), Elsevier.
- [43]Sarwar Sayeed, Hector Marco-Gisbert, and Tom Caira, "Smart Contract: Attacks and Protections", (2020), IEEE.
- [44]Santiago Bragagnolo, Henrique Rocha, Marcus Denker, Stephane Dacasse, "SmartInspect: Solidity Smart Contract Inspector", (2018), IEEE.
- [45]Weiqin Zou, David LO, Pavneet Singh Kochhar, Xuan-Bach D.LE, Xin Xia, Yang Feng, Zhenyu Chen, Baowen Xu "Smart Contract Development: Challenges and Opportunities",
- [46]Christopher D.Clack, Vikram A.Bakshi, Lee Braine, "Smart Contract Templates: Foundation, Design Landscape and Research Direction", (2017), ACM.
- [47]Patrick Dai, Neil Mahi, Jordan Earls, Alex Norta, "Smart-Contract Value Transfer Protocols on a Distributed Mobile Application Platform", (2017), IEEE.
- [48] John Lindsay, "Smart Contracts for incentivizing sensor based mobile smart city applications", (2018), IEEE.

- [49]Eranga Bandara,Wee Keong Ng,Nalin, Ranasinghe and Kasun De, Zoysa,"Aplos:Smart Contracts Made Smart",(2019),Springer.
- [50]Tonglai Liu,Jigang Wu,Long Chen,Yalan Wu and Yinan Li,"Smart ContractBased Long TermAuction for Mobile Blockchain Computation Offloading",(2020),IEEE.
- [51]Saeed Mohammed Wazed,Ben Richard Hughes, Dominic O' Connor,John Kaiser ,"A Review of Sustainable solar irrigation system for Sub- Saharan Africa",(2018),IEEE.
- [52]AbhijitPathak,MohammadAmazUddin ,Md.JainalAbedin,Karl Andersson,Rashed Mustafa,Mohammad Shahadat Hossain,"IoT based Smart System to Support Agricultural Parameters:A Case Study",(2019),Elsevier.