Web Scraping based Smart irrigation system with telegram alerts for farmers

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2021 Fourth International Conference on Electrical, Computer and Communication Technologies (ICECCT) | 978-1-6654-1480-7/21/$31.00 ©2021 IEEE | DOI: 10.1109/ICECCT52121.2021.9616699

***Abstract*— The farmer in Indian country needs to update new technologies such as the Internet of Things (IoT), which plays a significant role in transforming the agriculture industry. The monitoring of crops, soils and temperature monitoring are the significant challenges where IoT can be a solution. The farms or crop fields will connect to IoT, where the farmers can monitor the sensor data such as crop growth, soil moisture, and other irrigation types of equipment. In this paper, the farmers get acknowledgement about their fields in multiple places through the telegram app. This proposed system will update live parameters like temperature values, soil moisture values, humidity values for any location in the Indian country with the help of the web scraping technique. In this way, the farmers can monitor the crop and protect their crops from heavy rainfalls, and they can also switch off and switch on the motors in their farm through telegram application. Moreover, the weather forecasting of any place in the entire Indian country is attached to the telegram app so that the farmers can benefit from financial loss in critical seasons.**

Keywords—Web scrapping, BLYNK app, Telegram, Irrigation.

I. INTRODUCTION

IoT based smart agriculture is based on preparing a robot that looks after the field and controls many factors like soil moisture and pesticide control. The sensors are inserted into the robot, which takes the input and acts as the individual output [1]. Smart agriculture is based on controlling or monitoring temperature, humidity and sending some pictures of the field to the farmer to know the area's status. The system uses a simple camera sensor for this process [2]. A model for smart agriculture using IoT proposes collecting agricultural production environment data to predict the weather. [3].LoRaWAN based Movement Tracker for Smart Agriculture, this model detects animal movement in the farming field and alerts the farmer about them. Through this, the farmer can save the area before it is destroyed. This GPS and LoRa are connected to the ESP32 board to processes the data. The data will be sent to the LCD via LoRa for monitoring purposes [4]. Enhanced innovative agriculture model makes different marketing agencies register through the cloud and upload the necessary crops at that time, through which the farmers can know which crop to grow [5]. Real-time analysis of weather parameters brings new solutions for farmers to determine the best ways to manage the agricultural fields. This article performed agriculture data analytics by association rules using the Appropriate algorithm [6]. Different types of sensors are used to make the water management systems smarter., LoRaWAN technology is used in agriculture for measuring water level, soil moisture and rain sensors [7]. The precise output based on the best inputs possible for an innovative agriculture system. The Arduino board is used to collect various information from the field and give accurate work. All the necessary results cannot be gained with this circuit even though it is precise [8]. Climate-smart agriculture for food security is an approach for transforming and linking the environment to overcome the financial problems of farmers [9]. ESP8266 Wi-Fi module based Smart Irrigation System using IoT enables the remote-control mechanism through a secure internet web connection to the user. This transmitted information is monitor and control by using IoT [10]. The scraping techniques are presented in this article [11], which significantly impact social networks. The website link data for housing market analysis and behaviour of humans are explained using the web scraping method [12]. To conduct a price survey of consumer products, the web scraping method is used to analyse saving time [13] statistically. The literature survey-based scraping technique is proposed and implemented in the Hardaway study. It uses import.io for grey literature [14]. Researchers around the world use google scholar profile to update their research articles and citations. The majority of the institutes use the h-index as their measuring parameter. The ranking of the scholars, professors, and assistant professors also depend on their google scholar profile. The article search based on google scholar portals is done through web scraping methods [15]. Similarly, the research-based psychological data is done by landers et al.[16]. The scraping techniques are also used to find the linkage issue in live social research, and the weather data is also monitored [17]. The traffic accident data and its meteorological data are also proposed with data mining with several variables designed and explained [18].

An innovative irrigation system is proposed in this article, and it entirely depends on the web scraping technique. This web scraping method gathers weather data from HTML

pages in various Indian websites that update daily weather data. The parameters such as humidity, temperature, rain forecasting, and storm alerts are all notified on Indian weather websites. This web scraping method gathers HTML script pages, and data analytics are dumped into an excel sheet. This web scraping method is integrated with the telegram application. The telegram application is always connected to the nodeMCU application, which is placed in farmers crop fields. So whenever the farmer wants to check his crop condition in any place in Indian country, he just opens a telegram application and sends the location name in the BOT third party application. The farmer will be notified of the moisture data, the temperature of location, crop condition, soil data and weather forecasting information will be reported live in the telegram app. Apart from the notification, the farmer can also control the motor using OFF and ON commands in the telegram app. So even when the farmer is out of the station, he can monitor the crop and his fields in any location of Indian country.

Section I discusses the system model, section II discusses the telegram application linked to the innovative irrigation system. Similarly, section III discuss the Web scraping methods for irrigation is explained briefly. Section IV discusses the results section along with figures and tables with high-quality images. Finally, section V concludes the project with benefits for farmers.

II. SYSTEM MODEL

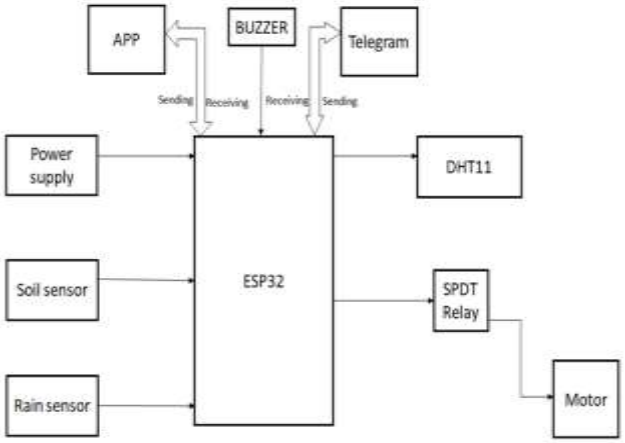

Figure 1. System model

The main component that is used in this device is NodeMCU. It is a processor that takes the data analyses, calculates, and compares the responses taken. The first step in the preparation of the device is writing the code. The code is written using different programming languages in the Arduino IDE software and checks for any errors after completing the code. If the code is perfect, then the code is dumped into the software. The component used to display all the functions being processed in the device is the LCD. After arranging the device in the correct place and giving the power supply, the system's functioning starts. The LCDs the system is ready to use for applications [19], [20].

The next is the system checks if there is any rain in the environment. If there are any changes in the environment, the sensors identify the changes and send them to the Telegram and blynk app simultaneously. Based on the temperature and humidity, the farmer can decide to switch the motor on or off. If the weather is low, then there is a chance of rain that can occur. If the temperature is high, then there is no chance of rainfall at that instant. If the humidity is high, the soil can absorb moisture from the environment, so there is no need for any water. If the humidity is low, then the soil will be dry and indicates the requirement of water [21]. And then, the device checks the moisture in the soil using a soil moisture sensor. If the moisture in the soil is high, there is enough water content in the soil required for plants. If the moisture in the soil is low, there is no enough water, which states water requirements. The motor can be turned ON or OFF based on the readings that we get from the sensors. The actions that we take on the device are constantly displayed on the LCD. The motor operation can be done either Telegram or blynk apps. This process continuously repeats automatically for every certainly given time interval, and required functions are performed. When the respective operations are completed, the information or the function that is going on gets displayed on the LCD. This process repeats in a loop manner infinite times and only stops when the power supply is off.

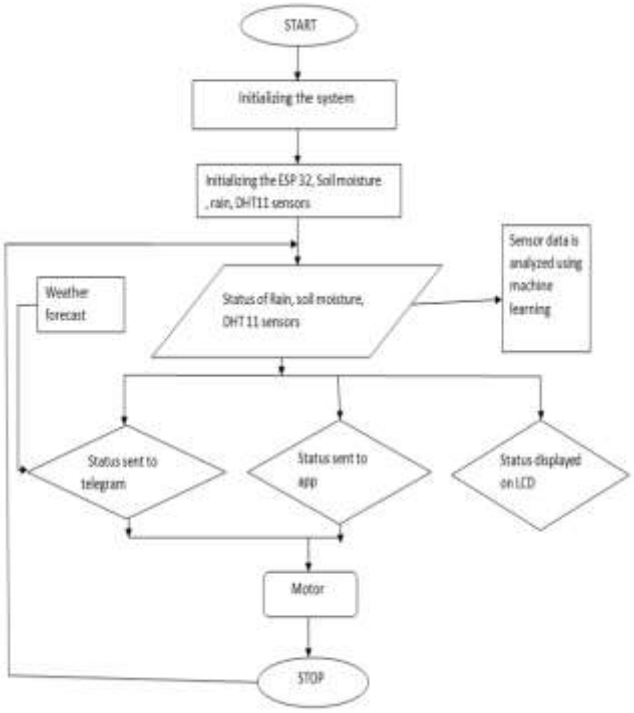

Figure 2. Flow chart of the system model

The working of the device is simple and can be operated by anyone. If the user wants the weather information that day or the next few days, there is an option. In the Telegram, if we type any city name that we are interested to know and send it, we will receive the weather data for the next few days. By viewing this information, we can decide about the action to be taken on the farm.

Algorithm:

STEP I: START and Initialise the Nodemcu board, Rain, soil moisture, DHT 11 sensors and 16*2 LCD.

STEP-II: Send the sensor data to the telegram app and Blynk app and display the same on LCD.
STEP III: If the user types ON in Telegram, go to STEP VII.
STEP IV: If the user types OFF in Telegram, go to STEP VIII.
STEP V: If the user clicks ON in Blynk app, go to STEP VII.
STEP VI: If the user types OFF in the Blynk app, go to STEP VIII.
STEP VII: Motor ON.
STEP VIII: Motor OFF.
STEP IX: Weather forecast data is sent to telegram when we type the city name in Telegram.
STEP X: END and Start over again the processes from STEP II into a continuous infinite loop.

A. Telegram alert creation for agriculture data

Telegram Messenger is a cloud-based instant messaging and voice over IP service. The main advantage over the WhatsApp application is that the bots can be created, which are small programs that will be interacting within the chat applications. Bots are third-party applications that run inside Telegram. Users can interact with bots by sending them messages, commands, and inline requests. The HTTP can also be used to control the bots to Telegram Bot API.

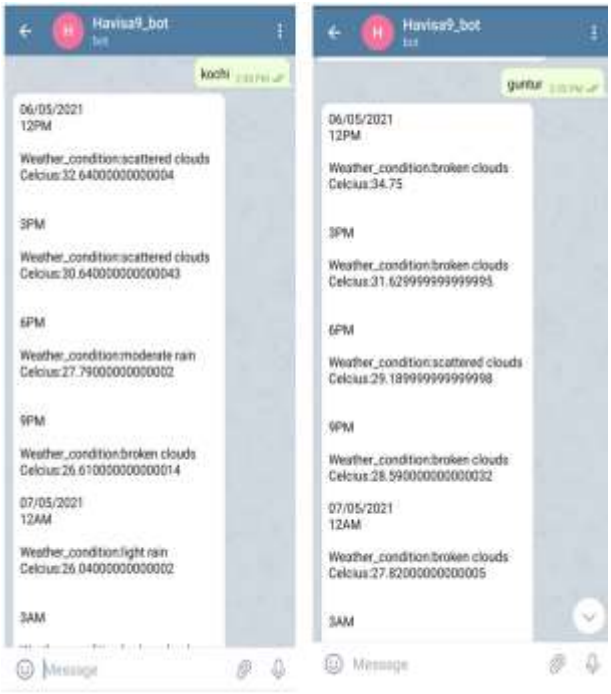

Figure 3. Telegram app screenshots show the interaction with ESP8266

B. Web scraping technique for gathering weather information

Web scraping is a data collection method with an application programming interface that interacts with the written program. This technique automatically requests data in HTML format from the web servers. The researchers use this method for data analysis and information security.

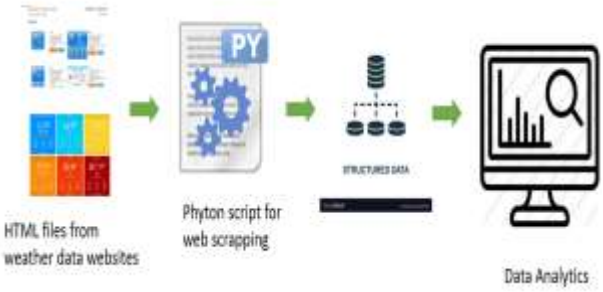

Figure 4. Web scraping processing steps

The first stage is the analysis phase of HTML documents from all the weather websites. In this stage, the sorting of data is done. The second stage is to programming creation with phyton with beautiful soup and request library. The scheduler will run scripting data every 1 hour, and the resulting data is stored in an excel file. The extraction of web scraping data is with the tool Pentaho kettle. Finally, the statics of weather data is obtained concerning application development, as shown in figure 4.
Web Weather Scraping Application developed using HTML Parsing created in Python programming language in Anaconda platform running on Windows Operating System Script created using Beautiful Soup 4 library the Requests library. The sites in scraping are https://en.climate-data.org/asia/india/karnataka/bengaluru-4562/

Program code or markup code for web scraping for smart irrigation system

```
import requests, json
import calendar
import urllib.request
import time
api_key = '16cac84e7b9fd5c9e28c2e0c079917e0'
api_call                                                    =
'https://api.openweathermap.org/data/2.5/forecast?appid='   +
api_key
running = True
prv=0
# Program loop
while running:
   # Asks the user for the city or zip code to be queried
   while True:

      # Input validation
         search=0

         # Passed the validation test
         if search == 0:
rsp=urllib.request.urlopen('https://api.telegram.org/bot1707489895
:AAFDVLOvhDzB8l9WMNf5etPGz0GLA5Z-
mkQ/getUpdates?offset=-1')
            res=rsp.read()
            c=res.split(b',"f')
            d=c[0].split(b'message_id":')
            b=res.split(b'text')
            data=b[1].split(b'"')
            print (d[1])
            #print(data[2])
            city=data[2]
            city=city.decode()
            mid=d[1].decode()
```

```
            mid=int(mid)
            if(prv != mid):
                prv=mid
                print(city)
                if city.lower() == 'sf':
                    city = 'Bengaluru, India'
                # Appends the city to the api call
                api_call += '&q=' + city
                break
    # Stores the Json response
    json_data = requests.get(api_call).json()

    location_data = {
        'city': json_data['city']['name'],
        'country': json_data['city']['country']
    }

    print('\n{city}, {country}'.format(**location_data))

    # The current date we are iterating through
    current_date = ''
    final_str='%0A'
    # Iterates through the array of dictionaries named list in json_data
    for item in json_data['list']:

        # Time of the weather data received, partitioned into 3 hour blocks
        time = item['dt_txt']

        # Split the time into date and hour [2018-04-15 06:00:00]
        next_date, hour = time.split(' ')

        # Stores the current date and prints it once
        if current_date != next_date:
            current_date = next_date
            year, month, day = current_date.split('-')
            date = {'y': year, 'm': month, 'd': day}
            print('\n{m}/{d}/{y}'.format(**date))

            final_str=final_str + str(day) + '/' + str(month) + '/' + str(year)

        # Grabs the first 2 integers from our HH:MM:SS string to get the hours
        hour = int(hour[:2])

        # Sets the AM (ante meridiem) or PM (post meridiem) period
        if hour < 12:
            if hour == 0:
                hour = 12
            meridiem = 'AM'
        else:
            if hour > 12:
                hour -= 12
            meridiem = 'PM'
        # Prints the hours [HH:MM AM/PM]
        print('\n%i:00 %s' % (hour, meridiem))
        final_str=final_str + '%0A' +str(hour)+str(meridiem) + '%0A'
        # Temperature is measured in Kelvin
        temperature = item['main']['temp']
        # Weather condition
        description = item['weather'][0]['description']
        # Prints the description as well as the temperature in Celcius and Farenheit
        print('Weather condition: %s' % description)
        ss=description.split(' ')
        x=len(ss)
        final_str=final_str + '%0AWeather_condition:' + str(ss[0])
        if(x==2):
            final_str=final_str + '%20' + str(ss[1])
        if(x==3):
            final_str=final_str + '%20' + str(ss[2])


        print('Celcius: {:.2f}'.format(temperature - 273.15))
        final_str=final_str + '%0ACelcius:' + str(temperature - 273.15) + '%0A%0A'
        print('Farenheit: %.2f' % (temperature * 9/5 - 459.67))
    # Prints a calendar of the current month
u=urllib.request.urlopen('https://api.telegram.org/bot1707489895:AAFDVLOvhDzB8l9WMNf5etPGz0GLA5Z-mkQ/sendMessage?chat_id=914829653&text='+str(final_str))
```

III. RESULTS AND DISCUSSIONS

Table 1. List of hardware components

Devices	Reference	Value/ID
Inductor	L1	270 nH
Capacitor	C1	100 uF
Integrated Circuit	DUINO? LCD 1, SOIL 1, U1, RAIN 1	NodeMCU, LM016L (LCD), Soil Moisture Sensor, DHT 11(temperature+humidity sensor), Rain sensor
Others	Potentiometer, DC motor, Power supply, Voltmeter, relay	1K, 12V, +5V

Table 1 shows the list of components used for designing the hardware circuit, the NodeMCU is mainly used processor which connects to the other components such as soil sensor, temperature sensor and rain sensor. The motor is connected to the nodeMCU along with telegram interface.

Figure 5. moisture in the soil, so the motor is turned off using the Telegram

Figure 5 and figure 6 shows the alerts are displayed in Telegram concerning the hardware kit. The different sensors are integrated into nodeMCU. The status of the temperature, humidity, rainfall is shown in LCD. Apart from the variable's status, the control of the motor is also connected to the telegram app directly. So farmers can control the

irrigation motor with their smartphone. The web scraping technique data is done through phyton script, the structured information is formed through a beautiful scoop, and finally, the data is downloadable through an excel sheet. Figure 7 is the data taken from Indian weather data monthly wise and plotted in df format. The parameters on the website are temperature, humidity, wind speed and dew points are all on average. It also displays the rainfall for monthly in mm, number of rainy days in a month, and humidity percentage monthly. Figure 8 shows the plots of monthly data in Bengaluru city, in which the highest rainfall happens in September month. The maximum temperature observed in April month. The minimum temperature observed is in the month of February.

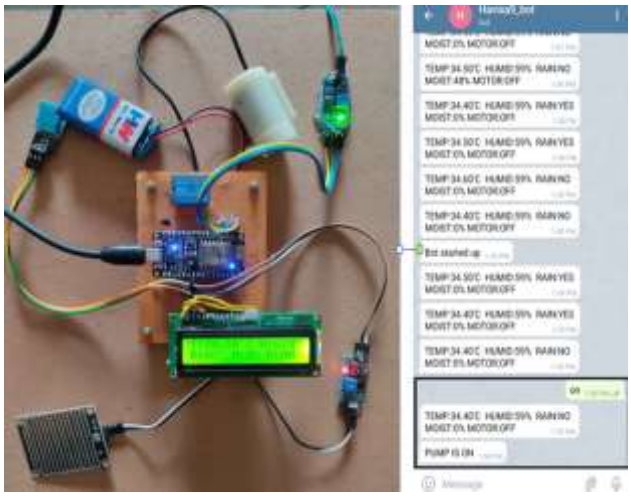

Figure 6. There is no rain and no moisture in the soil, so the motor should be turned on using Telegram

	Average temparature (°f)	Average humidity	Average dew point (°f)	Average windspeed(kmph)	Rainfall for month (mm)	Rainy days	average sunhours(hours)	Maximum temparture (°f)	Minimum Temparature (°f)	Humiduty percentage
SEP	72.3	60	59.5	5.2	194.6	12	6.4	80	66.2	78
AUG	71.9	57	57.5	5.7	117.8	15	5.7	79	66.2	79
JUL	72.3	26	51.2	5.5	100.3	15	6.1	79.5	66.9	78
JUN	73.8	54	52.4	4.7	85.7	14	6.8	81.5	68.3	76
MAY	77.9	59	53.4	4.6	96	11	9.5	88.2	69.8	65
APR	80	48	54.5	4.3	44.5	5	10.6	91.1	69.4	51
MAR	77.8	42	41.2	4.2	16	2	10.4	89.8	65.6	41
FEB	73	41	42.1	4.5	6.4	1	9.8	85.3	61	46
JAN	69.3	45	51.2	4	2.3	1	8.9	81.2	58.4	56

Figure 7. Web scrapping data for Bengaluru city for last year

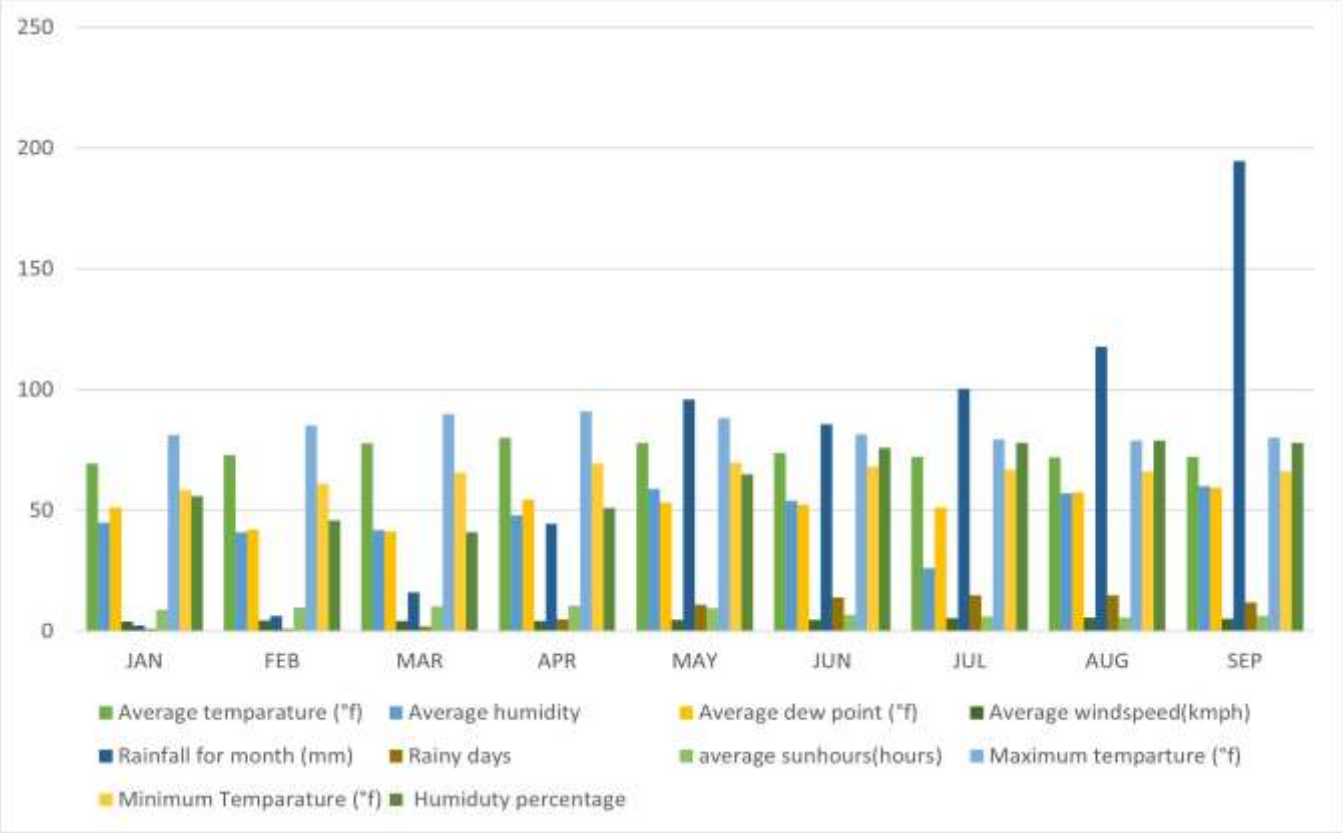

Figure 8. chart plotted for monthly data for various parameters in Bengaluru city.

IV. Conclusion

This project mainly concentrates on helping the farmers who cannot afford expensive devices that bring technological advancement. This device is available to farmers at an affordable price which also brings technological advancement. The device is also portable and consumes low power. Simple and basic sensors are used in this device to make it easy to operate. A farmer can efficiently manage it by switching on the switch, which is very easy, and there is no need for primary education. This can bring a change in the agricultural methods eradicating some traditional techniques. The smart irrigation system developed proves that the use of water can be diminished for a given amount of fresh biomass production.

References

[1] Nikesh Gondchawar , Prof. Dr. R. S. KawitkarT ―IoT based Smart Agriculture‖, journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 6, June 2016.

[2] S. R. Prathibha ; Anupama Hongal ; M. P. Jyothi―IOT Based Monitoring System in Smart Agriculture‖ , 2017 International Conference on Recent Advances in Electronics and Communication Technology (ICRAECT).

[3] KA Patil, NR Kale― A model for smart agriculture using IoT ‖, 2016 International Conference on Global Trends in Signal Processing, Information Computing and Communication (ICGTSPICC), 543-545, 2016

[4] Sofwah Alimin Mahama Chedaod , Aznida Abu Bakar Sajak , Jasrina Jaafar ,Mohd Sallehin Mohd Kassim ― LoRaWAN based Movement Tracker for Smart Agriculture ‖,

[5] Dipali Pawar ― Enhanced smart agriculture model, "A Model for Smart Agriculture Using IoT" International Conference on Global Trends in Signal Processing, Information Computing and Communication, 2016.

[6] George Suciu, Hussain Ijaz, Ionel Zatreanu, Ana-Maria Drăgulinescu―Real time analysis of weather parameters and smart agriculture using IoT ‖, international Conference on Future Access Enablers of Ubiquitous and Intelligent Infrastructures, 181-194, 2019

[7] Joaquín Gutiérrez, Juan Francisco Villa-Medina, Alejandra Nieto-Garibay, and Miguel Ángel Porta- Gándara" Automated Irrigation System Using a Wireless Sensor Network and GPRS module" , Ieee Transactions OnInstrumentation And Measurement, Vol. 63, No. 1, January 2014.

[8] An Automatic Irrigation System using ZigBee in Wireless Sensor Network" 2015 International Conference on Pervasive Computing (ICPC)- IEEE 2015 by Pravina B. Chikankar, Deepak Mehetre , Soumitra Das Computer Engineering Department K J College

[9] Stefanos A. Nikolidakis , Dionisis Kandris,Dimitrios D. Vergadoschristos Douligeris A"Energy Efficient Automated Control Of Irrigation In Agriculture By Using Wireless Sensor.

[10] Sukriti1 , Sanyam Gupta2 , Indumathy K3 IoT based Smart Irrigation and Tank Monitoring System, International Journal of Innovative. Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organisation) Vol. 4, Issue 9, September 2016

[11] Renita Crystal Pereira, Vanitha T, "Web Scraping of Social Networks," International Journal of Innovative Research in Computer and Communication Engineering, vol. 3, no. 7, pp. 237–240, Oct. 2015.

[12] G. Boeing and P. Waddell, "New Insights into Rental Housing Markets across the United States: Web Scraping and Analysing Craigslist Rental Listings," Journal of Planning Education and Research, vol. 37, no. 4, pp. 457–476, Dec. 2017.

[13] F. Polidoro, R. Giannini, R. L. Conte, S. Mosca, and F. Rossetti, "Web scraping techniques to collect data on consumer electronics and airfares for Italian HICP compilation," Statistical Journal of the IAOS, vol. 31, no. 2, pp. 165–176, May 2015.

[14] N. R. Haddaway, "The Use of Web-scraping Software in Searching for Grey Literature," vol. 11, no. 3, p. 6, 2015.

[15] A. Josi and L. A. Abdillah, "PENERAPAN TEKNIK WEB SCRAPING PADA MESIN PENCARI ARTIKEL ILMIAH," p. 6.

[16] R. N. Landers, R. C. Brusso, K. J. Cavanaugh, and A. B. Collmus, "A primer on theory-driven web scraping: Automatic extraction of big data from the Internet for use in psychological research.," Psychological Methods, vol. 21, no. 4, pp. 475–492, 2016.

[17] N. Marres and E. Weltevrede, "SCRAPING THE SOCIAL?: Issues in live social research," Journal of Cultural Economy, vol. 6, no. 3, pp. 313– 335, Aug. 2013.

[18] K.-J. Stol and B. Fitzgerald, "A Holistic Overview of Software Engineering Research Strategies," in 2015 IEEE/ACM 3rd International Workshop on Conducting Empirical Studies in Industry, Florence, Italy, 2015, pp. 47–54.

[19] Telagam, Nagarjuna, Menakadevi Nanjundan, Nehru Kandasamy, and Soma Naidu. "Cruise Control of Phase Irrigation Motor Using SparkFun Sensor." *Int. J. Online Eng.* 13, no. 8 (2017): 192-198.

[20] Telagam, N., Kandasamy, N., Nanjundan, M., & Arulanandth, T. S. (2017). Smart Sensor Network based Industrial Parameters Monitoring in IOT Environment using Virtual Instrumentation Server. Int. J. Online Eng., 13(11), 111-119.

[21] Kandasamy, Nehru, Nagarjuna Telagam, Seshagiri Rao V. R, and T. S. Arulananth. "Simulation of Analog Modulation and Demodulation Techniques in Virtual Instrumentation and Remote Lab." *Int. J. Online Eng.* 13, no. 10 (2017): 140-147.