South Asian Journal of Engineering and Technology Research Article

Open Access Full Text Article 123(2022) 9-19 DOI: 10.26524/sajet.2022.12.34

IoT BASED INDUSTRIAL AUTOMATION

[1]Dr. S. Kannappan, [a]K. kanchana, [b]B. Haritha, [c]K. Bhavana, [d]T. Madhu Priya, [e]G. Lokesh
[1]Associate Professor, ECE, GATES Institute of Technology, Gooty, AP
[abcde]B. Tech Students, ECE, GATES Institute of Technology, Gooty, AP

Corresponding author.
Correspondence: **Dr. S. Kannappan**
E-mail: kannapan54@gmail.com

Article info
Received 15 th February 2022 Received in revised form 25 March 2022 Accepted 1 July 2022

Keywords
People, funtion, human effort.

Abstract
The number of industries in a certain region is increasing year by year due to the increasing needs of people, and therefore intelligent industrialization automation can be used. Here the air quality in the industry and the number of products manufactured in the industry are monitored using gas detectors (to detect toxic or toxic gases) and IR sensors (to count the number of products manufactured) where there is no need for labor. Also to see estimated time of arrival of delivery vehicle GPS is used to get latitude, longitude and estimated time of delivery vehicle in real time. The branch of the delivery vehicle is displayed via the APP that can be built with Android Studio, this GPS is integrated in the NODE MCU. In the case of industrial fire accidents, this can be detected using the industry existing flame sensors built into the NODE MCU and the LCD screen where sprinklers are later activated.

INTRODUCTION:-

Due to population growth, people's needs are increasing year by year, which leads to the development and establishment of more and more industries. In the past, the purpose of automation was to increase productivity and reduce the costs associated with human operators. When the word industry comes up, words like big, big and huge come to mind. Where monitoring the whole industry in retail handling is not an easy task, it requires many workers to check the function of the device and the working environment of the industry and track the package. Therefore, this experimental setup is proposed to reduce the human effort.

Industrial automation is the process of making industrial production processes more flexible and simple with greater efficiency. The integration of automation into industry leads to intelligent manufacturing solutions with improved product quality and productivity with reduced downtime and scrap. Industrial automation includes the use of various control devices such as PC/PLC, various sensors and actuators, communication buses/modules, machine drives, HMI (Human Machine Interface) systems and other control devices.

Industrial automation:

This type of automation is most commonly used in automotive, computing and electronics, medical, telecommunications, consumer goods, and other industrial applications. The automation systems can be fixed, programmed, flexible and integrated systems.

Some of the types of industrial automation are listed below:

Numerically controlled machines:

These machines are computer-controlled machines that use computers to perform the control operations by sensing, processing, calculating and controlling the process variables. This automation is a programmed version of machine tools and is also known as a CNC (Computerized Numerical Controlled) machine. These CNC machines are used in cutting and milling applications for high accuracy and precise precision operation.

Computer Aided Manufacturing (CAM):

The entire manufacturing process (including production, planning and control) is automated through the use of numerically controlled machines, industrial robots and other types of automation devices. These automation systems also use computers to plan, design and shape the various products. Examples of this automation system are Computer Aided Design (CAD), Computer Aided Design and Drafting (CADD), and Computer Aided Process Planning (CAPP).

Industrial robots:

These are a type of automated machines or devices that can perform the various tasks for a long period of time. These are mostly used in areas that are highly dangerous or hazardous to humans.

Now that we've seen a little about the layout of a typical industrial automation system, let's move on to discussing the different types of industrial automation systems.

LITERATUE SURVEY :-

On November 2014 the author Li Da Zu Proposed Internet of Things in industries [1]. Industrial Automation Using Internet of Things (IOT) In this paper, they are developing a system which will automatically monitor the industrial applications and generate Alerts/Alarms or take intelligent decisions using concept of IoT. On 2014 the author Sadeque Reza Khan proposed GUI based Industrial Monitoring and control system [2]. IOT is achieved by using local networking standards and remotely controlling and monitoring industrial device parameters by using Raspberry Pi and Embedded web server Technology. Raspberry Pi module consists of ARM11 processor and Real Time Operating system whereas embedded web server technology is the combination of embedded device and Internet technology. Using embedded web server along with raspberry pi it is possible to monitor and control industrial devices remotely by using local internet browser. The author Ayman Sleman & Reinhard Moeller proposed integration of wireless sensor network service into other home industrial networks [3]. They have developed new technologies that have allowed us to move from the First generation of the Internet into the current transition into the Fourth generation. This generation has been propelled by the concept of the Internet of Things (IoT). On 2013 the author Rajeev Piyare & Seong Ro Lee proposed Smart home control and Monitoring system using smart phone proposed "IOT BASED AUTOMATED TEMPERATURE AND HUMIDITY MONITORING AND CONTROL" [4]. A raspberry pi running with Linux OS coded with C++ program that retrieves the temperature as well as humidity readings and these

values are sensed and sent to the internet. On 2011 the author Jinsoo Han, Chang-Sic Choi, Wan-Ki park, Iiwoo Lee Green Home Energy Management System through comparison of energy usage between the same kinds of home appliances [5].

The concept of the internet of things was introduced by the members of the radio frequency identification development community in 1999.This concept is very popular because of growth of mobile devices, embedded and real time communication, cloud computing and data analytics. The internet of things is a network of physical objects are embedded with electronics, software and sensors having the ability to collect data from the world around us and share data across the internet. The author Geng Wu,Shilpa Talwar,Kerstin Johnsson, Nageen Himyat & Kevin D. Johnson proposed M2m from mobile to internet [6]. A connected healthcare environment promotes the quick flow of information and enables easy access to it. Improved home care facilities and regular health updates to clinicians reduce the chances of redundant or inappropriate care, improve patient care and safety, and reduce overall costs of care. Connected health solutions can also be used to track lifestyle diseases such as hypertension, diabetics and asthma which need continuous monitoring. The IoT-MD provides an environment where a patient's vital parameters get transmitted by medical devices via a gateway onto secure cloud-based platforms where it is stored, aggregated and analyzed. It helps store data for millions of patients and perform analysis in real time, ultimately promoting an evidence-based medicine system. On 2011 the author Xiang Zang, Hui-Hong Wang proposed the design and implement of embedded M2M smart home system [7]. M2M communication is something that involves a large number of intelligent machines that share information and make collaborative decisions without direct human intervention. This potentially leads to achieving improved cost efficiency. M2M offers the telecommunication industry a great opportunity as it needs a lot of communication systems via various technology families, such as IP, RFID, sensor networks, smart metering, etc. On 2012 the author Takasha Yamanoue, Kentaro oda, koichi shimozono aM2M system using Arduino, Android & wiki software [8] The data generated in a smart grid is more than that generated in a traditional grid due to the continuous two way communication between the parent utility and the smart meter at the customer's home or business setup. If the infrastructure isn't ready for such communication, it can be a barrier to smart grid deployment. Here, IoT technology plays an important role. It can help streamline the transfer of high-volume data over an internet protocol. The IoT is also needed to establish seamless and effective communication between context aware sensors and the smart meter installed at the user site for automatically switching the devices on or off based on load patterns.On 2022 the author Jeyaselvi ,M., M.Satya, S. Suchitra, S. Jafar Ali Ibrahim, and N. S. Kalyan Chakravarthy [9] proposed the "SVM -Based cloning and Jamming Attack Detection in IOT sensor Networks". Advances Information Communication Technology and computing. In 2021 Ibrahim, Jafar Ali S., S.Rajasekhar, Varsha, M.Karunakaran, K. Kasirajan, Kalyan NS Chakravarthy, V. Kumar, and K.J. Kaur [10] proposed "Recent advances in performance and effect of Zr doping with ZnO thin film sensor in ammonia vapour sensing."

PROPOSED METHOD:-

This proposed structure can be used in small industry (rubber industry, steel industry, etc.).

This post covers the following actors:

a. How to check industrial air quality:

b. To check the number of products manufactured

c. For detecting fires in industry

i.e. to track the delivery vehicle

The working environment in the industry plays a key role because even if a small percentage of toxic gases are present in the workplace, it can cause health problems for people who oversee the industry and also for people associated with the industry, i.e. the Industrial air quality is monitored with gas detectors built into the Raspberry Pi and the LCD, which actually reduces the number of routine air quality inspections that people in the industry perform.

A lot of work is required to verify the quantity of products manufactured in the industry. To reduce labor there are 2 IR sensors on the sides of the machines where the products pass between the IR sensors and built into the Raspberry Pi and the LCD screen. Where in the industry can workers be saved for this task.

A fire accident is mainly caused by a malfunction of machines. To detect this fire, use flame sensors built into the Raspberry Pi. Once the fire is detected, the water sprinklers will activate to reduce the crowd Fire.

Real-time latitude and longitude of delivery vehicles can be obtained by integrating GPS (Global Positioning System) with the Raspberry Pi in the delivery vehicle, then saves the received value in the cloud storage and later shows the user the latitude and longitude via an APP to be developed with Android Studio. Use this method in case of a theft of the vehicle, it can be determined using its latitude and longitude.

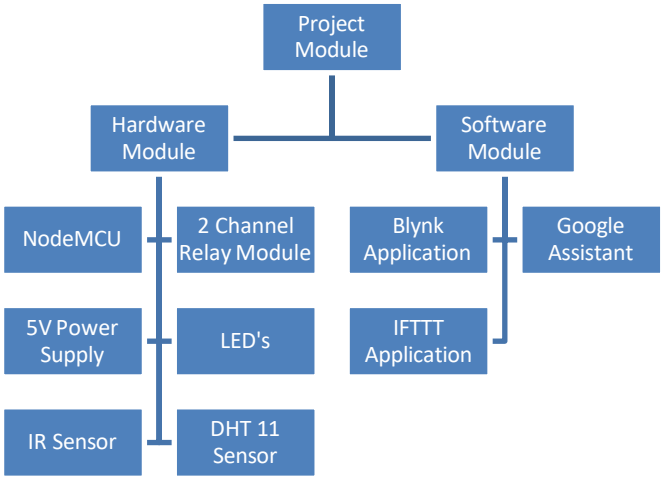

Figure 1 :- Project Layout of Proposed System

NodeMCU: NodeMCU is the microcontroller unit in the prototype. It has a built-in Wi-Fi module (ESP8266), which makes wireless remote switching of home appliances.

Two Channel Relay Module: The Two-channel Relay module consists of 4 individual relays that are physically connected between node MCU and the home appliances. It takes signals from GPIO pins of the node MCU and accordingly connects or disconnects household appliances from the mains. They act as a switching device.

LED: LED are used in this prototype to replace real devices. They show power turn devices on and off. In real-time operation, they would be replaced by actual ones domestic appliances.

Blynk Application: The Blynk application was built for the Internet of Things. It can remotely control hardware, it can display sensor data, save data, visualize, etc. The prototype mainly uses Blynk Application to capture commands from user to hardware over wireless network.

Google Assistant: Google Assistant is a system software that is present on the Android phone. It interprets the voice user commands to turn a device on or off.

IFTTT Application: The voice commands interpreted by the Google Assistant are not understandable therefore, the Blynk application cannot send to the hardware. IFTTT is an intermediate application which interprets commands from the Google Assistant and sends an on and off signal to the Blynk application about Blynk Server.

IR Sensor: An infrared sensor (IR sensor) is a radiation-sensitive optoelectronic component with a spectral sensitivity in the infrared wavelength range 780 nm … 50 μm. IR sensors are now widely used in motion detectors, which are used in building services to switch on lamps or in alarm systems to detect unwelcome guests**.**

DHT 11 SENSOR: The DHT-11 Digital Temperature and Humidity Sensor is a basic, ultra low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air and spits out a digital signal on the data pin (no analog input pins needed).

BLOCK DIAGRAM :-

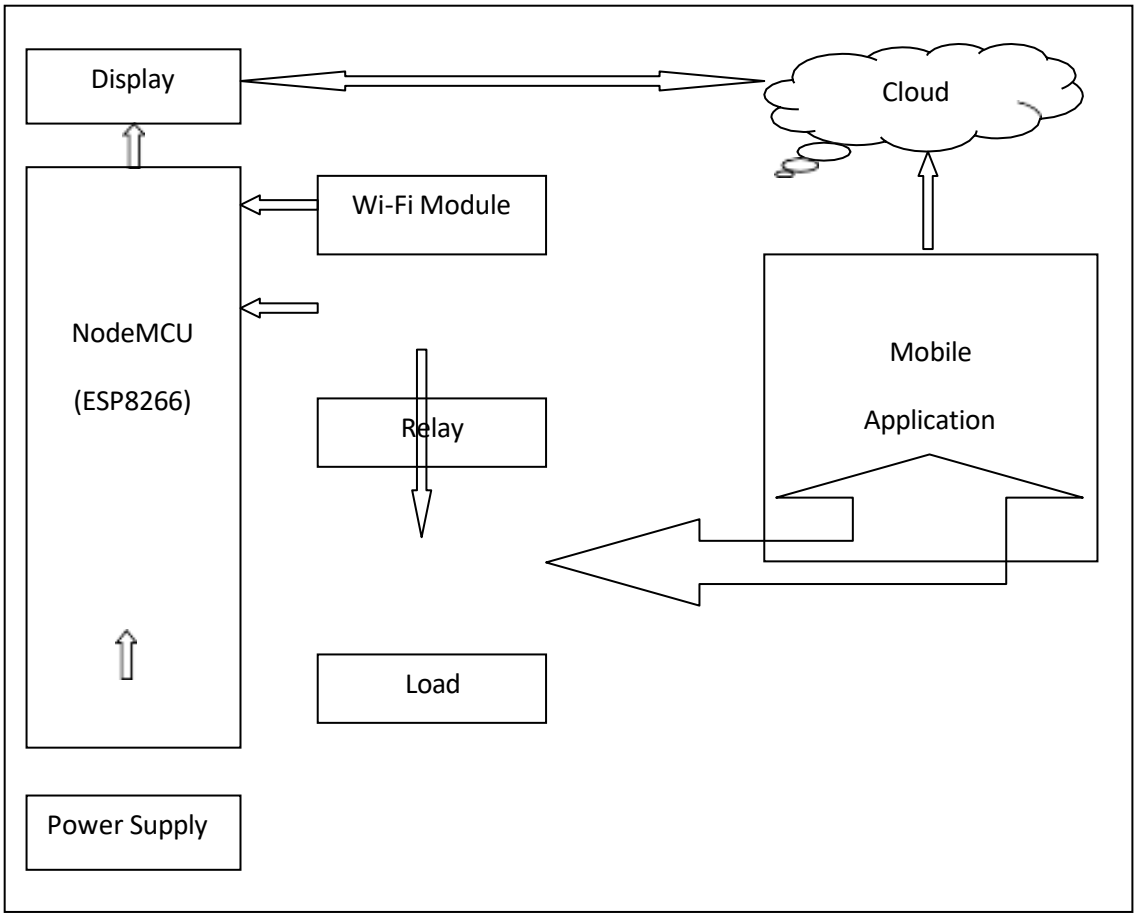

Figure 2:- Block Diagram of Proposed System

CIRCUIT DIAGRAM:

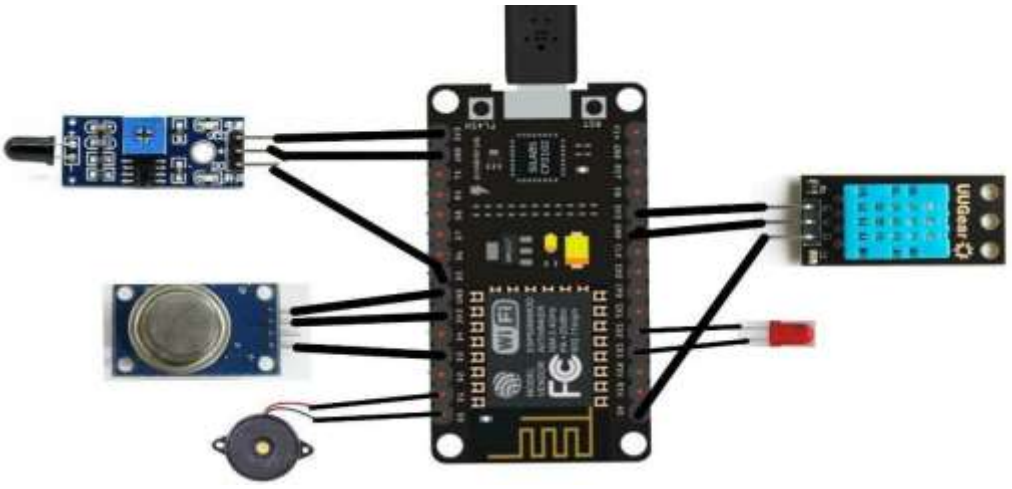

Figure 3: Circuit Diagram of Proposed System

WORKING:-

The proposed system uses a DHT11 sensor to detect temperature changes and humidity changes. NodeMCU is used to achieve desired operations. The DHT11, fire and smoke sensors are connected to NodeMCU with jumper cables. Whenever the sensors detect unusual changes in their readings, NodeMCU alerts the buzzer. And also sends information to mobile via the Blynk cloud. The whole system is powered by a 9V power supply.

The proposed system has the following functional steps

a. The NODEMCU board is used to dump the program, with the code written in the Arduino IDE programming using the injected C encoding.

b. The core of the circuit is the DHT11 sensor.

c. The SUMMER are used in this project.

i.e. The BLYNK cloud is connected to NODEMCU.

e. It detects the temperature and humidity changes in the environment.

Below are the steps to create the proposed system:

The Raspberry Pi is a single-board computer with an ARM processor [approx. 700 MHz], with 256 to 512 MB of RAM memory and with an additional slot for a memory card. Set up and configure the Raspberry Pi by placing it on a non-metallic surface, connect the USB mouse and keyboard to the Raspberry Pi, and later connect the 5V adapter power supply to the Pi and set up Enter the Raspbian operating system.

A flame sensor is activated when it encounters radiation, which the human eye perceives as a yellow-red flame and smoke. Once the Raspberry Pi is configured, connect the flame detectors to the Raspberry Pi's GPIO pins and power the flame sensor is on given to the flame sensor of Raspberry Pi. A flame detector is used over a heat detector and a smoke detector because it responds faster and more accurately. When the flame detectors encounter radiation and heat from a point, the flame sensor will become active and send the message to the Raspberry Pi, and later the Raspberry Pi will display the same information on the LCD and activate the water sprinklers to reduce the amount of fire in the industry.

Gas detectors are used to detect flammable gases and toxic gases that leak due to machine malfunction, when these gases can cause health problems for the people who work and live in the industry. A gas detector is connected to the Raspberry Pi's GPOI pins, and the gas detector is powered by the Raspberry Pi. When the gas is detected by the gas detector, it will send the message to the Raspberry Pi and the Raspberry Pi will display the message on the LCD display. With this method, the hassle of regularly checking the air quality can be avoided. An MQ-2 gas sensor can be used.

To check the amount of product going through the machine this can be seen with the 2 IR

sensors on the sides of the machine [2] where TSOP1736 can be used driven by a BC557 transistor bias and later send to the Raspberry Pi. The TSOP1736 IR sensor is said to have a photo detection response of 36 KHz.

GPS (Global Positioning System) receivers are used to get real time

Latitude and longitude of the vehicle by connecting the GPS to the Raspberry Pi's GPIO pins using TTL (Transistor Transistor Logic) and powering the GPS from the Raspberry Pi which is 3.3V, the latitude and longitude The delivery vehicle is retrieved and stored in the cloud, and later displayed in the APP developed by Android Studio, where the responsible persons of the delivery team can access the APP and get the real-time value and the estimated time of arrival of the delivery vehicle.

RESULT:-

Industrial automation is the control of machinery and processes used in various industries by autonomous systems through the use of technologies like robotics and computer software.

Industries implement automation to increase productivity and reduce costs related to employees, their benefits and other associated expenses, while increasing precision and flexibility.

With the Industrial Revolution came mechanization, which brought cheaper and more plentiful goods. Generally, the mechanical processes in industries were faster and produced greater quantities of goods but still required skilled workers. Not only did machines require operators but when errors occurred, they would waste materials, cause production issues and even damage equipment.

With the arrival of automation, control loops were added to machine operation. These can be open control loops that allow for human input or closed loops which are fully automated. Industrial control systems (ICS) allow for monitoring and control locally and remotely. With these increasingly advanced control mechanisms, industries can operate 24 hours a day. Productivity has increased, errors are reduced, and quality is improved. However, automation does have some negative impact, including high initial costs, reduced worker employment and the elimination of some ethical human oversight. As automation continues to advance and gain popularity in new industries, it is possible to see these events increase.

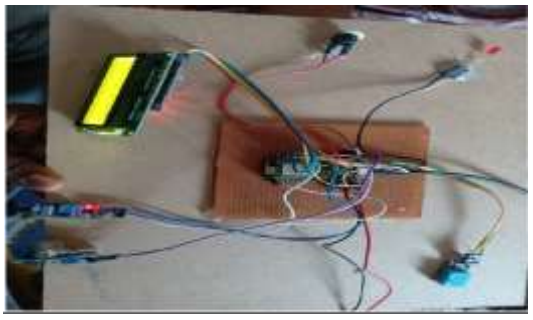

Figure 4 :- Proposed System Implementation

The sensors such as temperature (dht11), humidity(dht11), gas sensors (mq2) are used to sense the parameter values and if they are above the threshold as per the program in raspberry pie it will display on the screen and also updates through blynk app.

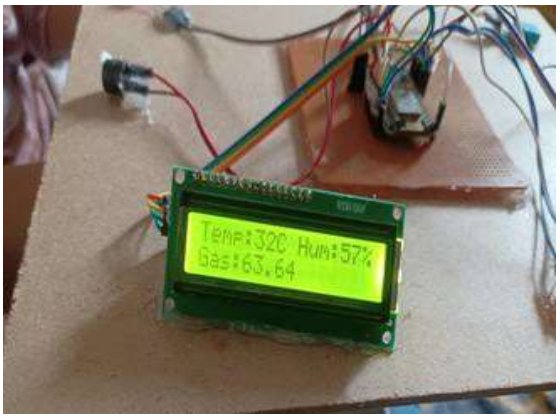

Figure 5: Displaying the parameters measured on LED screen

In the blynk app the measured parameter are updates such as range of gas is 63ppm and temperature range is 32℃ humidity range is 57% for a certain condition. Depends on room temperature the values are changed.

Figure 6 : Updating of parameters measured in blynk app

CONCLUSION:-

This security System is cheaply made from low-cost available components and can be used to control more than others. This system is easily adjustable at any industry or office space. The designed system was tested a number of times and successfully control from different place. Finally, this security system can be also implemented over Bluetooth, Infrared and WI-FI connectivity without much change to the design. Hence, this system is scalable and flexible.

REFERENCES:-

1. Li Da Zu" Internet of Things in Industries: A Survey" IEEE Transactions on Industrial Informatics, vol. 10, no. 4, November 2014
2. Sadeque Reza Khan Professor Dr. M. S. Bhat "GUI Based Industrial Monitoring and Control System ``IEEE paper, 2014
3. Ayman Sleman and Reinhard Moeller ``Integration of Wireless Sensor Network Services into other Home and Industrial networks "IEEE paper.
4. Rajeev Piyare and Seong Ro Lee`` Smart Home-Control and Monitoring System Using Smart Phone'' ICCA 2013, ASTL Vol. 24, pp. 83 - 86, 2013 © SERSC 2013.
5. Jinsoo Han, Chang-Sic Choi, Wan-Ki Park, Ilwoo Lee Green home energy management system through comparison of energy usage between the same kinds of home appliances 2011 IEEE 15th International Symposium on Consumer Electronics.
6. Geng Wu, Shilpa Talwar, Kerstin Johnsson, Nageen Himayat, and Kevin D. Johnson, Intel (2011): M2M from mobile to Internet.
7. Xiang Yang, Hui-hong Wang (2011): The design and implement of embedded M2M Smart Home System
8. Takashi Yamanoue, Kentaro Oda, Koichi Shimozono (2012): A M2M system using Arduino, Android and Wiki Software.
9. Jeyaselvi M., M. Sathya, S. Suchitra, S. Jafar Ali Ibrahim, and N. S. Kalyan Chakravarthy. "SVM-Based Cloning and Jamming Attack Detection in IOT Sensor Networks." Advances in Information communication Technology and computing, pp.461-471. Springer Singaore, 2022. https://link.springer.com/chapter/10.1007/978-19-0619-0_41.
10. Ibrahim Jafar Ali S., S. Rajasekhar, Varsha, M.Karunakaran, K. Kasirajan, Kalyan NS Chakravarthy, V.Kumar, and K. J. Kaur. "Recent advances in performance and effect of Zr doping with ZnO thin film sensor in ammonia vapour sensing."GLOBAL NEST JOURNAL 23,

no. 4(2021): 526-531. https://doi.org/10.30955/gnj.004020.