RESEARCH PARKS

INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071

Volume: 5 Issue: 8 | Aug 2023

Automatic Field Monitoring and Detection of Plant Diseases Using IoT

Akila Begum H

Department of Electronics and Communication Engineering, Dhaanish Ahmed College of Engineering, Chennai, Tamil Nadu, India

Yasmin A

Bachelor of Engineering, Department of Electronics and Communication Engineering, Dhaanish Ahmed College of Engineering, Chennai, Tamil Nadu, India

T. Ashmi

Assistant Professor, Department of Electronics and Communication Engineering, Dhaanish Ahmed College of Engineering, Chennai, Tamil Nadu, India

---***---

Annotation: This research presents a GSM-based system for automatic plant disease diagnosis and describes its use in the creation of ACPS. Traditional farming methods were largely ineffective against microbial diseases. In addition, farmers can't keep up with the ever-changing nature of infections, so a reliable disease forecasting system is essential. To circumvent this, we employ a Convolutional Neural Network (CNN) model that has been trained to examine the crop image recorded by a health maintenance system. The solar sensor node is in charge of taking pictures, sensing continuously, and automating smartly. An agricultural robot is sometimes known as an agribot or agbot. An autonomous robot with agricultural applications. It helps the farmer improve crop productivity while decreasing the need for manual labour. In the future, these agricultural robots could replace human labour in a variety of farming tasks, including tilling, planting, and harvesting. These agricultural robots will manage pests and diseases as well as perform tasks like weeding. In order to keep an eye on the crops and streamline the irrigation process, this system is equipped with disease prediction technology for plants and intelligent irrigation controls. The energy required to provide disease prediction and irrigation systems separately is reduced by combining them in this project.

Keywords: Automatic Field Monitoring, Detection of Plant Diseases, Internet of Things.

Introduction

Due to rising populations and subsequent food demands, agriculture will continue to use the vast majority of the world's freshwater resources [12]. Due to the shortage of water and advances in technology, we have developed a wide variety of methods for efficiently and effectively using water for agricultural purposes. With automatic irrigation scheduling based on direct soil water readings, cotton yields and water use efficiency have both been optimised [13-15]. Estimating plant evapotranspiration is an alternate metric for watering requirements in agriculture (ET). Solar radiation, temperature, relative humidity, and wind speed are some of the climatic characteristics that influence ET, along with crop aspects like growth stage, variety, plant density, management elements, soil properties, and pest and disease control. To reduce water use by 53% compared to sprinkler watering in 1000 m2 of pasture, a system based on an electromagnetic sensor to assess soil moisture was developed. By adjusting irrigation to daily changes in weather or volumetric substrate moisture content, a soil sensor and an evaporimeter have helped reduce water use in scheduled systems as well [16-19]. Using decision-support software and its connection with an infield wireless sensor network (WSN) operating a modified irrigation machine with programmable spray nozzles, a system was designed to optimise irrigation for large-scale malting barley cultivations [20-24].

INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY
https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 5 Issue: 8 | Aug 2023

Objective

- Everyone needs food to live, so access to it is a precious commodity.
- With the help of this project, agricultural land may produce more with less inputs.
- In this way, farmers can keep up with the ever-changing threats posed by viruses and plant diseases.
- The farmer can discover crop diseases sooner with the help of the crop disease prediction system.

Assembling and coordinating all parts to carry out a task or set of tasks in accordance with a predetermined set of rules is the hallmark of an embedded system [25]. A washing machine or a wristwatch are both embedded systems. A computer system in which the software is directly integrated into the hardware is called an embedded system. It creates a subsystem that is solely responsible for one function within a bigger application or product [26-29]. The embedded system could be programmable or non-programmable, depending on the task at hand. Appliances like dishwashers, microwaves, cameras, printers, and even cars all use embedded systems [30]. Digital signal processors, microprocessors, and other specialised processors are used (DSP). Components of embedded systems, embedded system types, and defining features are all covered in the introduction to embedded systems (fig.1).

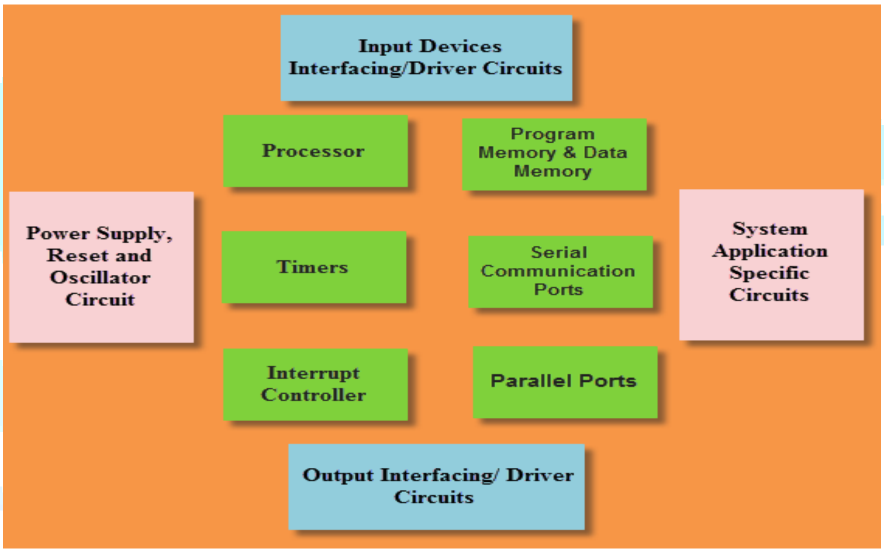

Figure 1: Embedded System Block Diagram [8]

Hardware, Embedded system software, and an Operating System are the three pillars upon which an embedded system rests [31-33]. An embedded system, like any other electronic system, must have a hardware platform on which to run. A microprocessor or microcontroller is typically used in the construction of embedded system hardware [34]. The embedded system's hardware consists of the processor, memory, display, and user interfaces. Embedded systems often run on specialised software designed to carry out a given task. The code is often written in a high-level language and compiled into an executable form before being stored in the hardware's non-volatile memory [35-39]. Because of these three constraints, embedded system software must be carefully crafted. A system is considered real-time if its timely operation and provision of the service it provides are critical. The application programme is controlled and the processor is allowed to run thanks to the real-time operating system [40-44]. The Real-Time OS is the software layer between the computer's hardware and the programmes that use that hardware. An RTOS is optimised to run time-sensitive programmes with a large degree of consistency [45-49]. In measurement and industrial automation systems, where downtime can be expensive or a delayed programme can pose a safety risk, this can be especially useful (fig.2).

INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY
https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 5 Issue: 8 | Aug 2023

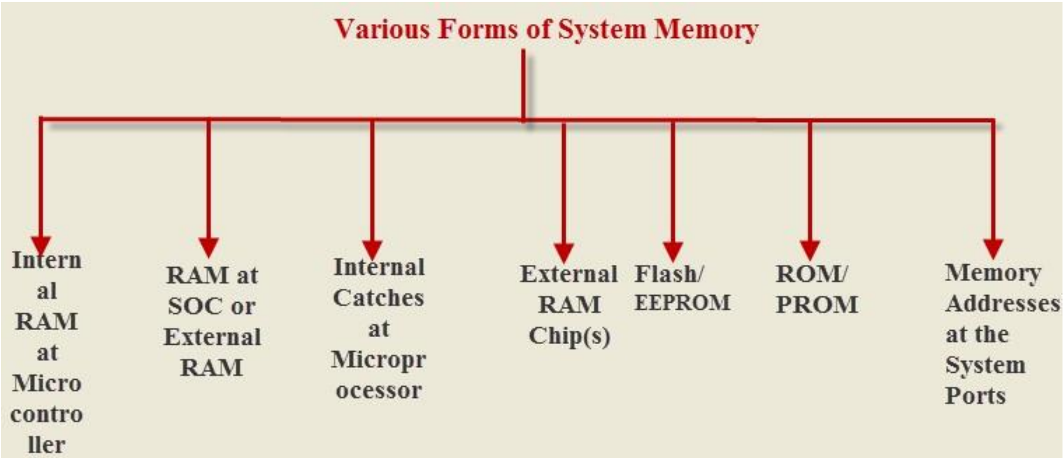

Figure 2: Various Forms of Systems Memory [8]

Several varieties of storage can be found in an embedded system. Remembering can take many shapes, and this chart shows them all [50-55]. Microprocessors (DSP), Digital Signal Processors (DSP), microcontrollers, RISC processors, Application Specific Integrated Circuit (ASIP) processors, Arm processors, and ASSP processors are only few of the processor types utilised in embedded systems [56-61]. The microprocessor is a versatile processor that can be integrated onto a very large-scale integrated circuit. The following table lists the many microprocessor families seen in embedded systems [62-67].

Embedding a DSP:

When it comes to embedded systems, a processor like a digital signal processor is a crucial component. Audio, video, multimedia, image processing, a DSP modem, high-definition television, and telecommunications processing systems are all examples of DSP applications [68-71]. These processors are also employed in DNA sequence and picture pattern recognition systems. In the following table, we list the many DSP families utilised in embedded systems (fig.3) [72-75].

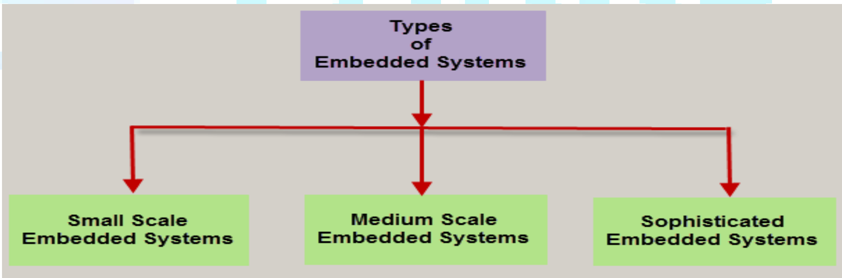

Figure 3: Classification of Embedded Systems

The microcontroller in a small-scale embedded device typically has 16 bits of memory and can run on a single AA battery. The primary programming tools for creating embedded software for these systems are an editor, an assembler, a (IDE) integrated development environment, and a cross-assembler [76-81].

Medium-Scale Embedded Systems are built around a single or small number of 16- or 32-bit microcontrollers, digital signal processors, or RISCs. The hardware and software in these systems are very sophisticated. When creating embedded software for these systems, the following programming tools are utilised. These include a C compiler, a C++ compiler, Visual C++, Java, an RTOS, a debugger, a simulator, and an IDE (integrated development environment) [82-85].

RESEARCH PARKS
INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY
https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 5 Issue: 8 | Aug 2023

Complex Embedded Systems Complex embedded systems may require PLAs, Ips, ASIPs, and scalable or adjustable processors due to the large amount of hardware and software complexity involved. They are put to use in state-of-the-art applications that need for a unified design of hardware and software [86].

Embedded systems can be used for a variety of purposes. Smart cards, communications, satellites, missiles, digital consumer electronics, computer networking, etc. are just a few examples of where embedded systems are put to use. Fundamentals and practical uses of embedded systems are discussed. Regardless of the circuit complexity, embedded systems are fantastic and necessary in many gadgets, industrial instrumentation, equipment, and appliances [87-94].

The agricultural practises of today are evolving at a lightning pace. Food product pricing, supply chain, and distribution are all impacted by the world's expanding population and ever-changing trade policies. Organic food and sustainably produced vegetables and fruits are becoming increasingly popular among consumers, especially in Western countries [95-97]. In India, agriculture employs over 53% of the population. Labor shortages and rising expenses for farm work are a result of the agriculture industry's need to respond to growing and shifting demands. Automation in agriculture is a solution to the aforementioned issues, which is why agricultural modernisation has emerged. By using automation in several steps of agricultural production, this technique accomplishes its primary purpose of minimising the need for man labour [98-101]. To do tasks like ploughing, planting, and pruning, an autonomous vehicle is built and controlled to do so. Controlling a car from a distance is possible because to the employment of high-tech sensors and communication systems. An irrigation system is planned that watered the field depending on the weather forecast and the soil moisture level in order to minimise water waste. In order to accomplish this, a technique is developed to select the appropriate crop for the season based on weather forecasts. In this study, we create a prototype tractor specifically for ploughing. A DC motor operated by an H-bridge allows the vehicle to be steered in any direction [102-105]. The motor is remotely operated by the farmer from his mobile device in the field via Bluetooth connection. This research study introduces automated planter and cultivator vehicles [1].

Today, farmers do much more than just provide food for their communities' expanding populations. It's significant everywhere, not just in the 70% of Asian countries where the majority of the population works in agriculture. That's a wide variety of people it's able to nourish. Reduced crop quality due to illness must be the top priority. The ability to detect disease could be crucial in preventing agricultural losses. The ultimate goal of this project is to create a computer programme that can automatically detect and categorise sickness. Illness detection entails a number of steps, including image loading, preprocessing, segmentation, extraction, and classification. The images of the leaves are then utilised to identify afflicted plants. Therefore, the image processing method is effective in agricultural applications for detecting and categorising illnesses [2].

One area where machine learning has found use is in the creation of an automatic detector for plant diseases. Expert laboratory methods for diagnosing plant diseases are generally impractical for rapid, low-cost rollouts. Images of leaves and fruits are utilised as input data in machine learning methods. We create data-driven, disease-classification-optimal features that are discriminatory. Because of the considerable intra- and inter-variability of the data, extracting useful features from the photos might be difficult. This work introduces a convolutional autoencoder-based unsupervised feature learning system for disease detection in plants. There are two primary benefits to employing a convolutional autoencoder. To begin with, the network may eventually learn to develop discriminative features on its own, rendering the need of handcrafted features redundant. Second, there is no need to label any data because the process is unsupervised. Here, we feed the results from the autoencoder into SVM-based classifiers to identify plant illnesses automatically. When compared to an autoencoder with fewer hidden layers, this technique performs better [3].

INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY
https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 5 Issue: 8 | Aug 2023

Agriculture provides a significant means of subsistence. Rural residents of developing countries like India might find enough work in the agricultural sector. There are many different crops grown in India, and a recent assessment found that this sector of the economy supports the livelihoods of about 70% of the country's people. Because of a lack of access to technology training, most Indian farmers now practise manual farming methods. Farmers typically don't know much about what crops work best on their land. There will be a decrease in both the quantity and quality of agricultural products when plants are infected by diverse illnesses through their leaves. The rapid development of plants and the increased yield of crops are both dependent on their leaves. It is difficult for both farmers and scientists to recognise plant illnesses in the leaves. When farmers spray pesticides on crops, it has repercussions for human health and the economy. Many quick methods need to be adopted to detect these plant diseases. In this study, we provide a comprehensive overview of plant diseases and the state-of-the-art methods currently available for diagnosing them [4].

In addition to humans, all other forms of life require water to function as a vital natural resource. Water resources such as rivers, lakes, and reservoirs affect how much water can be used. Water contamination has made water a scarce resource, that's for sure. We design an Internet-of-Things-based environmental water management monitoring system to collect data on water quality, which is essential for ensuring water's continued usefulness as a natural resource. Raspberry Pi as an embedded system will facilitate the production of sensing devices, and remote communications technology will facilitate the exchange of data between objects. As a result, the Internet of Things water quality monitoring system can be used as a fully automated, web-based surface water monitoring system [5].

A healthy and sustainable ecosystem depends on green plants, which are essential to human well-being. This highlights the need of cultivating robust vegetation. If the plant illness could be diagnosed early on, it might be treated. In this study, we propose using a Raspberry Pi to monitor a farm for signs of plant health and send alerts to the farmer through email when problems are found. We have performed numerical calculations using the tensor flow tool. It has the ability to detect indications in farms with a regulated environment [6].

Rapid advancement in food production technologies is necessary to keep up with the growing demand for food. Many different kinds of crops and plants exist. Plants and crops have varying needs for moisture, nutrients, and sunshine. In a country like India, agriculture is a major economic driver. India's economy depends heavily on its farmers, who put in long hours to ensure maximum agricultural yields [106-111]. However, natural disasters might cause agricultural difficulties, which can disrupt the regularly scheduled irrigation of crops. The primary cause is the dry weather and inadequate supply of water in land reservoirs. The water level on Earth is falling due to humankind's relentless thirst for water. Therefore, this causes more land to become unusable for farming. Wasted water is another major issue on the global agenda. As the global population grows, so does the need for water, making water conservation an increasingly urgent issue today. In order to ensure that plants and crops receive water at the optimal moment [7], smart irrigation systems have been proposed and developed [112-116].

Methodology Dataset

In order to detect leaf diseases in plants, we have used our dataset to collect photos of plant leaves. There are hundreds of RGB photos in the collection, divided into eight groups that represent different states of health for plant leaves.

Data Collection

The data is captured and stored as images of the plant's leaves. Infected leaves of various plants are photographed with mobile phones or digital cameras. The photos are processed using image analysis methods to extract information. The leaves of a rose plant were harvested for this purpose [117].

Image Acquisition

The first step is to gather information from the plants. The image is read in as data for analysis. We have implemented support for common image file types such as.bmp,.jpg, and.gif. Here, our software is given images of plant leaves in order to detect the disease. JPEG is the most common image file format, and higher resolution photographs will be used for analysis [118-121].

Image Pre Processing

Dust, spores, and water spots are all examples of noise that could be present in field-collected photos. In order to change the pixel values, data must first be preprocessed, which involves removing noise from the image. The image is improved as a result. Normalizing an image is a common procedure that modifies the intensity range of individual pixels. Its usual function is to normalise the pixel values of an input image so that they appear more consistent to the human eye. The vein picture from each leaf is extracted by converting the original RGB image into a black-and-white image. Image editing is the practise of improving upon an existing image for use in a particular context. The purpose of picture enhancement is to draw attention to specific parts of an image that could otherwise be overlooked [122-129].

Median filtering is a common method of digital noise reduction [130]. It is a non-linear filtering technique. Noise reduction like this is a common preprocessing procedure used to boost post-processing outcomes (for example, edge detection on an image). Images and transmissions can have noise removed using the median filter method. When removing noise from images, the median filter is essential because of its reputation for maintaining image edges (fig.4).

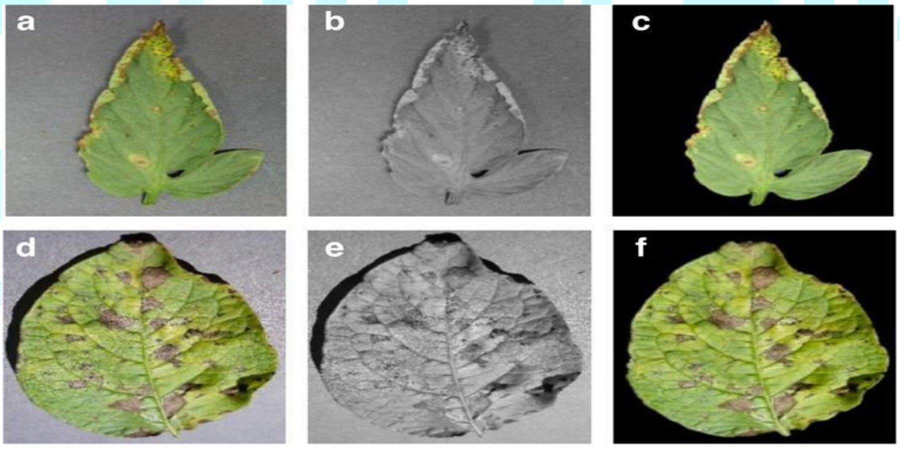

Figure 4: Image Pre Processing [9]

Segmentation

The third and last stage of our proposed strategy is image segmentation. Using the convolutional neural network (CNN) technique, the segmented images are grouped into distinct regions. The photos' RGB colour space is converted to the Lab colour space before clustering. The Lab colour model was developed to facilitate the organisation of segmented images into groups. Image Segmentation refers to the process of breaking down a digital picture into its constituent parts, or groups of pixels (also known as superpixels). When an image is segmented, it is broken up into smaller pieces that work together to form a boundary around the full picture, or it is reduced to a series of outlines. When it comes to distinguishable or predetermined characteristics like colour, form, and texture, every pixel in a region is quite near [131-139].

INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071

Volume: 5 Issue: 8 | Aug 2023

The next step is to apply some fundamental Morphological operations to the image in order to fill up any gaps. Filling in gaps or empty areas in an image is a morphological process. Furthermore, it does what its name implies and fills hollow shapes [140]. These voids, or holes, are represented by a set of background pixels that are surrounded by a boundary of foreground pixels [141].

Next, the picture gets binarized, or transformed into binary. Then, if the binary pixel value is 0, the associated RGB picture value is transformed (fig.5).

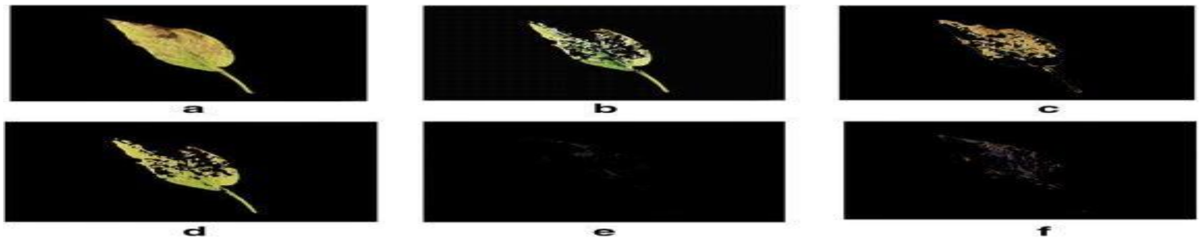

Figure 5: Segmentation

Feature Extraction

In this study, we focus on extracting four different types of form features: solidity, extension, minor axis length, and eccentricity. The affected area of the leaf is isolated using these characteristics.

The paper uses contrast, correlation, and energy to extract texture information. Using these characteristics, we may pinpoint the affected area of the leaf under analysis. Finally, we'll figure out how much each pixel and its neighbours differ from one another.

Color feature extraction has a special manner of demonstrating image representation with respect to translation, scaling, and rotation. Mean, skewness, and kurtosis are the features employed in the colouring process. In this process, we go from RGB to LAB.

Model Creation and Prediction Classification

Training sets and testing sets are the two types of data used in categorization. Each instance or piece of data in the training set has numerous properties in addition to the single target value. The primary focus here is on pinpointing the dividing hyperplane that separates these points into the positive and negative categories, respectively.

Convolutional Neural Network

In order to conduct convolution operations, CNNs, or convolutional neural networks, have a complex network topology. Input, convolution, pooling, full connection, and output layers make up the convolutional neural network model. In one model, the convolution layer and the pooling layer switch places multiple times, and partial connections between the neurons in the convolution layer and the pooling layer are sufficient. In the realm of deep learning, CNN is a common model. The core structural qualities of CNN provide it an edge in picture identification because to its large model capacity and complicated information. Meanwhile, deep learning's rising popularity can be attributed to CNN's achievements in computer vision tasks. When a test image is sent into a classification network, it performs analysis on the data and then outputs a label indicating how the image should be categorised. CNN classification networks use a complete connection layer (or average pooling layer) followed by a softmax structure for classification, with the feature extraction comprising a cascaded convolution layer + pooling layer.

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071

Volume: 5 Issue: 8 | Aug 2023

GSM Modem Applications

Figure 6: GSM Modem Applications [10]

The AT command interface is used to manage the GSM/GPRS modem via its serial interface (fig.6). A power supply and antenna are included. The modem's basic operational separation is described below. Calls over the phone are not a desirable target application. If interfaces like a microphone and speaker are made available in the future for certain software, this may become a viable option. Short Message Service (SMS) messages can also be used to send brief texts. It's possible for the transmitter to be a vending machine, a collection machine, or a navigation system that constantly sends out SMS messages at predetermined intervals. In areas without access to GSM data calls or GPRS services, SMS may be a viable alternative. Through short message service (SMS), access control devices can talk to servers and security personnel. Without requiring physical connection, the central server has immediate access to the whole history of all transactions. In event of danger, the device can immediately contact security staff via their cell phones. All of RaviRaj Technologies' Fingerprint Access control and time attendance products will soon feature this innovation. Transaction confirmations from centralised servers can be sent through SMS to EDC machines and POS terminals. The key perk is that the main server can be located anywhere in the world. Local servers in each city with numerous phone lines are necessary now. Both the upfront investment and the transaction fees you incur are greatly reduced. Nowadays, supply chain management necessitates a sizable IT infrastructure consisting of leased lines, networking devices, data centres, and workstations; nonetheless, significant downtimes and excessive prices persist. With GSM M2M technology, you can accomplish all of this at a fraction of the usual cost. You can receive real-time transaction data from all of your branch offices, warehouses, and business partners with zero downtime, low cost, and a central server in your headquarters that has GSM capabilities.

Applications Suitable for GSM Communication

GSM will be less expensive than other communication systems if your application requires one or more of their functionalities. Each transaction should only require one to three lines of data. Financial data, purchase/sale figures, consignment tracking info, etc. SMS messaging, which costs less than a local phone call and is sometimes free worldwide, can be used to transmit these brief but crucial bits of transaction data. As a result, you can deliver vital data to your headquarters from different locations around the world at little cost. While GSM allows for the transport of faxes and huge data files, the price is comparable to, if not more than, that of traditional landline networks. Having access to data from a wide variety of locations across your city, state, country, or planet will give

RESEARCH PARKS

INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071

Volume: 5 Issue: 8 | Aug 2023

you the most insight. Your company's satellite offices, partners, warehouses, and agents can all contribute data via GSM modems connected to personal computers, GSM electronic terminals, and mobile phones. Even though many businesses, such as warehouses, are located in outlying areas with limited or no landline or internet access, they will still have access to a GSM network. GSM mobile networks have higher uptime than landlines, the internet, and other communication mediums, making them an ideal choice for businesses that depend on constant connectivity. GSM is also reliable when you know that someone is going to try to disrupt your communication by, for example, cutting wires or tape landlines.

Several GSM SMS messages can be processed in a short amount of time. Similar to email, your server can store a large number of incoming SMS messages even when disconnected from the internet. When time is of the essence, SMS texts are much more reliable than e-mails. Store owners who accept credit cards using GSM networks rather than traditional landlines is just one example. Whereas local transaction servers are busy, it's because they're using numerous phone lines to process transactions at once, when in reality, a single GSM connection can handle hundreds. Unlike traditional phone lines, GSM terminals and modems can be easily relocated to a new place. In addition, GSM terminals enable mobile access to the server via a mobile phone. GSM modems, terminals, and mobile phones can be bought, SIM cards installed, and software set up in order to initiate GSM communication. When referring to a device or system that provides electrical or other types of energy to an output load or group of loads, the term "power supply" (often shortened to "PSU") is commonly used. The term is most generally used to describe electrical energy sources, occasionally referring to mechanical ones, and never to any others.

The input line voltage is transformed by the transformer, which also isolates the power source from the power line. The input signal of alternating current is changed into a direct current that pulses in the rectifier section. The last part, the regulator, controls the output. It keeps the power output stable regardless of the load current or the line voltage input. Now that you know your way around, you may use an AC signal to follow the power supply as it is being generated. At this stage, you need inspect each component of the power supply to determine how this signal is modified there. The transformer is a step-up type with a 1:3 turn ratio. The output voltage of this transformer is 345 volts ac (peak-to-peak) and may be calculated by multiplying the input voltage by the ratio of the primary turns to the secondary turns. Rectifier output is roughly 173 volts of alternating current (DC) due to the fact that each diode in the section conducts for just 180 degrees of the full 360-degree input. The rising and falling times of the changing signal are regulated by the filter section, which is a network of resistors, capacitors, or inductors. This results in a more stable DC level for the signal. When we talk about filter circuits, the filtration process will become clearer. The filter puts out a 110-volt dc signal with ac ripple superimposed on it. The average voltage drop will be discussed and its cause identified. The electronic devices run on a steady 110-volt dc supply, which is maintained by the regulator (more commonly called the load). When tinkering with digital devices, this compact +5V power supply circuit comes in handy. These transformers are widely accessible, although they typically have poor voltage regulation. This design's +5V output can be boosted to 1 A with proper cooling of the 7805-regulator chip. The current drawn by the circuit is currently around 150 mA. The input voltage to the circuit must be well above the capacitors' safe operating voltage. The circuit can be easily constructed on a single Vero board. What each pin does on a 7805 regulator IC.

The +5V output of the 7805 chips can be changed to any other voltage within the range of the regulator 78xx chip family by simply swapping out the chips. The output voltage is shown by the chip's final digit. For the regulator's output voltage to be stable, the input voltage must be at least 3 volts higher (figs. 7 and 8).

INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGY
https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 5 Issue: 8 | Aug 2023

Figure 7: Non-Affected Accuracy -99.67%

Figure 8: Blackspot Affected Accuracy -99.67% [11]

Conclusion

In this paper, we proposed a fully autonomous system to assist in watering a path of indoor potted plants. The mobile robot is capable of detecting when plants need watering and then watering them without any assistance from a human. An Arduino microcontroller, a water pump, a relay, a wireless temperature and humidity sensor, and soil information all make up the system. When a leaf disease is found, an alert will be sent to the appropriate person. An agricultural robot is sometimes known as an agribot or agbot. An autonomous robot with agricultural applications. It helps the farmer improve crop productivity while decreasing the need for manual labour. In the future, these agricultural robots could replace human labour in a variety of farming tasks, including tilling, planting, and harvesting. These agricultural robots will manage pests and diseases as well as perform tasks like weeding. This system has a disease prediction system and a sophisticated irrigation system.

References

1. B. Narayanavaram, E. M. K. Reddy, and M. R. Rashmi, “Arduino based automation of agriculture A step towards modernization of agriculture,” in 2020 4th International Conference on Electronics, Communication and Aerospace Technology (ICECA), 2020.

2. V. Pooja, R. Das, and V. Kanchana, "Identification of plant leaf diseases using image processing techniques," in 2017 IEEE Technological Innovations in ICT for Agriculture and Rural Development (TIAR), 2017.
3. H. F. Pardede, E. Suryawati, R. Sustika and V. Zilvan, "Unsupervised Convolutional Autoencoder-Based Feature Learning for Automatic Detection of Plant Diseases," 2018 International Conference on Computer, Control, Informatics and its Applications (IC3INA), Tangerang, Indonesia, 2018, pp. 158-162, doi: 10.1109/IC3INA.2018.8629518.
4. S. S. Kumar and B. K. Raghavendra, "Diseases detection of various plant leaf using image processing techniques: A review," in 2019 5th International Conference on Advanced Computing & Communication Systems (ICACCS), 2019.
5. R. P. N. Budiarti, A. Tjahjono, M. Hariadi, and M. H. Purnomo, "Development of IoT for automated water quality monitoring system," in 2019 International Conference on Computer Science, Information Technology, and Electrical Engineering (ICOMITEE), 2019.
6. G. Sahitya, C. Kaushik, P. S. Simha, D. Reddy, S. Kumar, and V. Vinay, "Leaf disease detection using raspberry pi," in 2022 13th International Conference on Computing Communication and Networking Technologies (ICCCNT), 2022.
7. H. N. Saha et al., "Smart Irrigation System Using Arduino and GSM Module," in 2018 IEEE 9th Annual Information Technology, Electronics and Mobile Communication Conference (IEMCON), 2018.
8. T. Agarwal, "Introduction to embedded system basics and applications," ElProCus - Electronic Projects for Engineering Students, 17-Oct-2016. [Online]. Available: https://www.elprocus.com/basics-of-embedded-system-and-applications/. [Accessed: 07-Aug-2023].
9. S. P. Mohanty, D. P. Hughes, and M. Salathé, "Using deep learning for image-based plant disease detection," Front. Plant Sci., vol. 7, p. 1419, 2016.
10. "Applications of GSM GPRS Modems 3G 4G 5G India GPRS FAQ's, GSM GPRS Modem, GSM Modem India," Ravirajtech.com. [Online]. Available: https://www.ravirajtech.com/Applications_of_GSM_Modem.html. [Accessed: 07-Aug-2023].
11. Gaspard, "Rose tree and disease - the most effective treatments," Nature & Garden, 03-Nov-2022. [Online]. Available: https://www.nature-and-garden.com/gardening/diseases-rose-tree.html. [Accessed: 07-Aug-2023].
12. P. Paramasivan, "A Novel Approach: Hydrothermal Method of Fine Stabilized Superparamagnetics of Cobalt Ferrite (CoFe2O4) Nanoparticles," Journal of Superconductivity and Novel Magnetism, vol. 29, pp. 2805–2811, 2016.
13. P. Paramasivan, "Controllable synthesis of CuFe2O4 nanostructures through simple hydrothermal method in the presence of thioglycolic acid," Physica E: Low-dimensional Systems and Nanostructures, vol. 84, pp. 258–262, 2016.
14. S. Ambika, T. A. Sivakumar, and P. Sukantha, "Preparation and characterization of nanocopper ferrite and its green catalytic activity in alcohol oxidation reaction," Journal of Superconductivity and Novel Magnetism, vol. 32, pp. 903–910, 2019.
15. P. Paramasivan, "Comparative investigation of NiFe2O4 nano and microstructures for structural, optical, magnetic and catalytic properties," Advanced Science, Engineering and Medicine, vol. 8, pp. 392–397, 2016.
16. P. Paramasivan, S. Narayanan, and N. M. Faizee, "Enhancing Catalytic Activity of Mn3O4 by Selective Liquid Phase Oxidation of Benzyl Alcohol," Advanced Science, Engineering and Medicine, vol. 10, pp. 1–5,

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 5 Issue: 8 | Aug 2023

2018.

17. H. Bulut and R. F. Rashid , "The Zooplankton Of Some Streams Flow Into The Zab River, (Northern Iraq)", Ecological Life Sciences, vol. 15, no. 3, pp. 94-98, Jul. 2020
18. Rashid, R. F., Çalta, M., & Başusta, A. (2018). Length-Weight Relationship of Common Carp (Cyprinus carpio L., 1758) from Taqtaq Region of Little Zab River, Northern Iraq. Turkish Journal of Science and Technology, 13(2), 69-72.
19. Pala, G., Caglar, M., Faruq, R., & Selamoglu, Z. (2021). Chlorophyta algae of Keban Dam Lake Gülüşkür region with aquaculture criteria in Elazıg, Turkey. Iranian Journal of Aquatic Animal Health, 7(1), 32-46.
20. Rashid, R. F., & Basusta, N. (2021). Evaluation and comparison of different calcified structures for the ageing of cyprinid fish leuciscus vorax (heckel, 1843) from karakaya dam lake, turkey. Fresenius environmental bulletin, 30(1), 550-559.
21. Rashid, R. (2017). Karakaya Baraj Gölünde (Malatya-Türkiye) yaşayan aspius vorax'da yaş tespiti için en güvenilir kemiksi yapının belirlenmesi/Determination of most reliable bony structure for ageing of aspius vorax inhabiting Karakaya Dam Lake (Malatya-Turkey).
22. S. Pandya, T. R. Gadekallu, P. K. Reddy, W. Wang and M. Alazab, "InfusedHeart: A Novel Knowledge-Infused Learning Framework for Diagnosis of Cardiovascular Events," in IEEE Transactions on Computational Social Systems, doi: 10.1109/TCSS.2022.3151643.
23. S. R. Vadyala, S. N. Betgeri, J. C. Matthews, and E. Matthews, "A review of physics-based machine learning in civil engineering." Results in Engineering, vol. 13, p. 100316, 2022, doi: 10.1016/j.rineng.2021.100316.
24. S. R. Vadyala, S. N. Betgeri, and N. P. Betgeri, "Physics-informed neural network method for solving one-dimensional advection equation using PyTorch." Array, vol. 13, p. 100110, 2022, doi: 10.1016/j.array.2021.100110.
25. S. R. Vadyala and E. A. Sherer, "Natural Language Processing Accurately Categorizes Indications, Findings and Pathology Reports From Multicenter Colonoscopy (Preprint)." 2021, doi: 10.2196/preprints.32973.
26. S. R. Vadyala, S. N. Betgeri, E. A. Sherer, and A. Amritphale, "Prediction of the number of COVID-19 confirmed cases based on K-means-LSTM." Array, vol. 11, p. 100085, 2021, doi: 10.1016/j.array.2021.100085.
27. D.K. Srivastava and B. Roychoudhury, "Words are important: A textual content based identity resolution scheme across multiple online social networks," Knowledge-Based Systems, vol. 195, 105624, 2020.
28. D.K. Srivastava and B. Roychoudhury, "Understanding the Factors that Influence Adoption of Privacy Protection Features in Online Social Networks," Journal of Global Information Technology Management, vol.24, no.3, pp. 164-182, August 2021
29. R. Agarwal and N. Rao, "ML-based classifier for Sloan Digital Sky spectral objects," Neuroquantology, vol. 20, no. 6, pp. 8329–8358, 2022, doi: 10.14704/nq.2022.20.6.NQ22824.
30. R. Agarwal, "Edge Detection in Images Using Modified Bit-Planes Sobel Operator," 2014, pp. 203–210. doi: 10.1007/978-81-322-1771-8_18.
31. A. Rashi and R. Madamala, "Minimum relevant features to obtain ai explainable system for predicting breast cancer in WDBC," Int J Health Sci (Qassim), Sep. 2022, doi: 10.53730/ijhs.v6nS9.12538.
32. R. A. A. Agarwal, "Decision Support System designed to detect yellow mosaic in Pigeon pea using

Computer Vision," Design Engineering (Toronto), vol. 8, pp. 832–844, 2021.

33. R. Agarwal, S. Hariharan, M. Nagabhushana Rao, and A. Agarwal, "Weed Identification using K-Means Clustering with Color Spaces Features in Multi-Spectral Images Taken by UAV," in 2021 IEEE International Geoscience and Remote Sensing Symposium IGARSS, Jul. 2021, pp. 7047–7050. doi: 10.1109/IGARSS47720.2021.9554097.
34. Roja Boina, "Assessing the Increasing Rate of Parkinson's Disease in the US and its Prevention Techniques", International Journal of Biotechnology Research and Development, 3(1), pp. 1-18, 2022.
35. Dhanush, S., Mohanraj, S.C., Sruthi, V.S., Cloudin, S., Joseph, F.J.J (2022). CODEDJ-Private Permissioned Blockchain Based Digital Wallet with Enhanced Security, IEEE International Conference on Bio-Neuro Informatics Models and Algorithms. IEEE.
36. Joseph, A.J.J, Joseph, F.J.J, Stanislaus, O.M and Das, D (2022). Classification methodologies in healthcare, Evolving Predictive Analytics in Healthcare: New AI techniques for real-time interventions, p 55-73. IET.
37. Joseph, F.J.J (2022). IoT Based Aquarium Water Quality Monitoring and Predictive Analytics Using Parameter Optimized Stack LSTM. In 2022 International Conference on Information Technology (InCIT). IEEE
38. Pattana-anake, V., & Joseph, F. J. J (2022). Hyper Parameter Optimization of Stack LSTM Based Regression for PM 2.5 Data in Bangkok, In 2022 International Conference on Business and Industrial Research (ICBIR). IEEE
39. Srisook, N., Tuntoolavest, O., Danphitsanuparn, P., Pattana-anake, V., & Joseph, F. J. J (2022). Convolutional Neural Network Based Nutrient Deficiency Classification in Leaves of Elaeis guineensis Jacq. International Journal of Computer Information Systems and Industrial Management Applications, 14, 19-27.
40. Joseph, F. J. J. (2022). IoT-Based Unified Approach to Predict Particulate Matter Pollution in Thailand. The Role of IoT and Blockchain: Techniques and Applications, 145-151.
41. Joseph, F. J. J. (2019, October). Twitter based outcome predictions of 2019 indian general elections using decision tree. In 2019 4th International Conference on Information Technology (InCIT) (pp. 50-53). IEEE.
42. Pattana-Anake, V., Danphitsanuparn, P., & Joseph, F. J. J. (2021, February). BettaNet: A Deep Learning Architecture for Classification of Wild Siamese Betta Species. In IOP Conference Series: Materials Science and Engineering (Vol. 1055, No. 1, p. 012104). IOP Publishing.
43. Joseph, F. J. J., & Auwatanamongkol, S. (2016). A crowding multi-objective genetic algorithm for image parsing. Neural Computing and Applications, 27(8), 2217-2227.
44. Ravi, T. (2011, March). Classification of correlated subspaces using HoVer representation of Census Data. In 2011 international conference on emerging trends in electrical and computer technology (pp. 906-911). IEEE.
45. O. Fabela, S. Patil, S. Chintamani and B. H. Dennis, "Estimation of effective thermal conductivity of porous Media utilizing inverse heat transfer analysis on cylindrical configuration," in ASME 2017 International Mechanical Engineering Congress and Exposition, 2017.
46. S. Patil, S. Chintamani, B. Dennis and R. Kumar, "Real time prediction of internal temperature of heat generating bodies using neural network," Thermal Science and Engineering Progress, vol. 23, 2021.
47. S. Patil, S. Chintamani, J. Grisham, R. Kumar and B. H. Dennis, "Inverse Determination of Temperature Distribution in Partially Cooled Heat Generating Cylinder," in ASME 2015 International Mechanical

Engineering Congress and Exposition, 2015.

48. M., M., & Mesbah, S. (2016). Effective e-government and citizens adoption in Egypt. International Journal of Computer Applications, 133(7), 7–13. https://doi.org/10.5120/ijca2016907886

49. Ead, W. M., & Abbassy, M. M. (2021). IOT based on plant diseases detection and classification. 2021 7th International Conference on Advanced Computing and Communication Systems (ICACCS). https://doi.org/10.1109/icaccs51430.2021.9441954

50. Ead, W., & Abbassy, M. (2018). Intelligent Systems of Machine Learning Approaches for developing E-services portals. EAI Endorsed Transactions on Energy Web, 167292. https://doi.org/10.4108/eai.2-12-2020.167292

51. Sadek, R. A., Abd-alazeem, D. M., & Abbassy, M. M. (2021). A new energy-efficient multi-hop routing protocol for heterogeneous wireless sensor networks. International Journal of Advanced Computer Science and Applications, 12(11). https://doi.org/10.14569/ijacsa.2021.0121154

52. Derindere Köseoğlu, S., Ead, W. M., & Abbassy, M. M. (2022). Basics of Financial Data Analytics. Financial Data Analytics, 23–57. https://doi.org/10.1007/978-3-030-83799-0_2

53. Ead, W. M., & Abbassy, M. M. (2022). A general cyber hygiene approach for financial analytical environment. Financial Data Analytics, 369–384. https://doi.org/10.1007/978-3-030-83799-0_13

54. Abbassy, M. M., & Ead, W. M. (2020). Intelligent Greenhouse Management System. 2020 6th International Conference on Advanced Computing and Communication Systems (ICACCS). https://doi.org/10.1109/icaccs48705.2020.9074345

55. Khalifa, I., Abd Al-glil, H., & M. Abbassy, M. (2013). Mobile hospitalization. International Journal of Computer Applications, 80(13), 18–23. https://doi.org/10.5120/13921-1822

56. Abbassy,M.M., & Mohamed A.A.(2016). "Mobile Expert System to Detect Liver Disease Kind", International Journal of Computer Applications, 14(5), 320–324.

57. Khalifa, I., Abd Al-glil, H., & M. Abbassy, M. (2014). Mobile hospitalization for Kidney Transplantation. International Journal of Computer Applications, 92(6), 25–29. https://doi.org/10.5120/16014-5027

58. Ead, W. M., Abbassy, M. M., & El-Abd, E. (2021). A general framework information loss of utility-based anonymization in Data Publishing. Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12(5), 1450–1456. https://doi.org/10.17762/turcomat.v12i5.2102

59. Abbassy, M. M., & Abo-Alnadr, A. (2019). Rule-based emotion AI in Arabic Customer Review. International Journal of Advanced Computer Science and Applications, 10(9). https://doi.org/10.14569/ijacsa.2019.0100932

60. Abbassy, M. M. (2020). The human brain signal detection of Health Information System IN EDSAC: A novel cipher text attribute based encryption with EDSAC distributed storage access control. Journal of Advanced Research in Dynamical and Control Systems, 12(SP7), 858–868. https://doi.org/10.5373/jardcs/v12sp7/20202176

61. Abbassy, M. M. (2020). Opinion mining for Arabic customer feedback using machine learning. Journal of Advanced Research in Dynamical and Control Systems, 12(SP3), 209–217. https://doi.org/10.5373/jardcs/v12sp3/20201255

62. M. Farman, A. Akgül, M.T. Tekin, M. M. Akram, A. Aqeel , E. E. Mahmoud, I. S. Yahia, "Fractal fractional-

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 5 Issue: 8 | Aug 2023

order derivative for HIV/AIDS model with Mittag-Leffler kernel", Alex. Eng. J, vol. 61, no. 12,pp. 10965-10980, April 2022.

63. AbdulKader, H., ElAbd, E., & Ead, W. (2016). Protecting Online Social Networks Profiles by Hiding Sensitive Data Attributes. Procedia Computer Science, 82, 20–27.
64. Fattoh, I. E., Kamal Alsheref, F., Ead, W. M., & Youssef, A. M. (2022). Semantic sentiment classification for covid-19 tweets using universal sentence encoder. Computational Intelligence and Neuroscience, 2022, 1–8. https://doi.org/10.1155/2022/6354543
65. Ead, W. M., Abdel-Wahed, W. F., & Abdul-Kader, H. (2013). Adaptive Fuzzy Classification-Rule Algorithm In Detection Malicious Web Sites From Suspicious URLs. Int. Arab. J. E Technol., 3, 1–9.
66. Abdelazim, M. A., Nasr, M. M., & Ead, W. M. (2020). A survey on classification analysis for cancer genomics: Limitations and novel opportunity in the era of cancer classification and Target Therapies. Annals of Tropical Medicine and Public Health, 23(24). https://doi.org/10.36295/asro.2020.232434
67. Alsheref, F. K., Fattoh, I. E., & M.Ead, W. (2022). Automated prediction of employee attrition using ensemble model based on machine learning algorithms. Computational Intelligence and Neuroscience, 2022, 1–9.
68. A, V. V. ., T, S. ., S, S. N. ., & Rajest, D. S. S. . (2022). IoT-Based Automated Oxygen Pumping System for Acute Asthma Patients. European Journal of Life Safety and Stability (2660-9630), 19 (7), 8-34.
69. A. K. Jain, D. S. Ross, M. K. Babu, Dharamvir, D. Uike and D. Gangodkar, "Cloud Computing Applications For Protecting the Information of Healthcare Department Using Smart Internet of Things Appliance," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India, 2022, pp. 229-234, doi: 10.1109/IC3I56241.2022.10072938.
70. A. K. Jain, T. Misra, N. Tyagi, M. V. Suresh Kumar and B. Pant, "A Comparative Study on Cyber security Technology in Big data Cloud Computing Environment," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India, 2022, pp. 235-241, doi: 10.1109/IC3I56241.2022.10072552.
71. Amit Kumar Jain, "Hybrid Cloud Computing: A Perspective," International Journal of Engineering Research & Technology, vol. 11, no. 10, p. 1, 2022.
72. Amit Kumar Jain, "Multi-Cloud Computing & Why do we need to Embrace it," International Journal Of Engineering Research & Technology, vol. 11, no. 09, p. 1, 2022.
73. Amit Kumar Jain, "Overview of Serverless Architecture," International Journal of Engineering Research & Technology, vol. 11, no. 09, p. 3, 2022.
74. Aryal, A., Stricklin, I., Behzadirad, M., Branch, D. W., Siddiqui, A., & Busani, T. (2022). High-Quality Dry Etching of LiNbO3 Assisted by Proton Substitution through H2-Plasma Surface Treatment. Nanomaterials, 12(16), 2836.
75. B. Tambaip, A. F. F. Hadi, A. P. Tjilen, and N. Jalal, "Optimizing Public Service Performance: Unleashing the Potential of Compassion as an Indicator of Public Service Motivation," FMDB Transactions on Sustainable Management Letters., vol. 1, no. 2, pp. 46-55, 2023.
76. Cristian Laverde Albarracín, Srinath Venkatesan, Arnaldo Yana Torres, Patricio Yánez-Moretta, Juan Carlos Juarez Vargas, "Exploration on Cloud Computing Techniques and Its Energy Concern", MSEA, vol. 72, no. 1, pp. 749–758, Feb. 2023.

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 5 Issue: 8 | Aug 2023

77. E. Vashishtha and G. Dhawan, "Bridging Generation Gap on Analysis of Mentor-Mentee Relationship in Healthcare Setting," FMDB Transactions on Sustainable Health Science Letters, vol. 1, no. 1, pp. 21–30, 2023.

78. F. B. Said and S. Tripathi, "Epistemology of Digital Journalism Shift in South Global Nations: A Bibliometric Analysis," FMDB Transactions on Sustainable Technoprise Letters, vol. 1, no. 1, pp. 47–60, 2023.

79. G. Nirmala, R. Premavathy, R. Chandar, J. Jeganathan, "An Explanatory Case Report on Biopsychosocial Issues and the Impact of Innovative Nurse-Led Therapy in Children with Hematological Cancer," FMDB Transactions on Sustainable Health Science Letters, vol. 1, no. 1, pp. 1–10, 2023.

80. Giovanny Haro-Sosa , Srinath Venkatesan, "Personified Health Care Transitions With Automated Doctor Appointment System: Logistics", Journal of Pharmaceutical Negative Results, pp. 2832–2839, Feb. 2023

81. Haq, M. A. (2021). DNNBoT: Deep Neural Network-Based Botnet Detection and Classification. Computers Materials and Continua, 71(1), 1769–1788.

82. Haq, M. A. (2021). SMOTEDNN: A Novel Model for Air Pollution Forecasting and AQI Classification. Computers Materials and Continua, 71(1), 1403–1425.

83. Haq, M. A. (2022). CDLSTM: A novel model for climate change forecasting. Computers, Materials and Continua, 71(2), 2363–2381. https://doi.org/10.32604/cmc.2022.023059

84. Haq, M. A., & Baral, P. (2019). Study of permafrost distribution in Sikkim Himalayas using Sentinel-2 satellite images and logistic regression modelling. Geomorphology, 333, 123–136. https://doi.org/10.1016/j.geomorph.2019.02.024

85. Haq, M. A., Ahmed, A., Khan, I., Gyani, J., Mohamed, A., Attia, E.-A., Mangan, P., & Pandi, D. (2022). Analysis of environmental factors using AI and ML methods. Scientific Reports, 12(1), 13267. https://doi.org/10.1038/s41598-022-16665-7

86. Haq, M. A., Alshehri, M., Rahaman, G., Ghosh, A., Baral, P., & Shekhar, C. (2021). Snow and glacial feature identification using Hyperion dataset and machine learning algorithms. Arabian Journal of Geosciences, 14(15). https://doi.org/10.1007/s12517-021-07434-3

87. Haq, M. A., Ghosh, A., Rahaman, G., & Baral, P. (2019). Artificial neural network-based modeling of snow properties using field data and hyperspectral imagery. Natural Resource Modeling, 32(4). https://doi.org/10.1111/nrm.12229

88. J. A. Jeba, S. R. Bose, R. Boina, "Exploring Hybrid Multi-View Multimodal for Natural Language Emotion Recognition Using Multi-Source Information Learning Model," FMDB Transactions on Sustainable Computer Letters., vol. 1, no. 1, pp. 12–24, 2023.

89. J. I. Ramos, R. Lacerona, J. M. Nunag, "A Study on Operational Excellence, Work Environment Factors and the Impact to Employee Performance," FMDB Transactions on Sustainable Social Sciences Letters, vol. 1, no. 1, pp. 12–25, 2023.

90. J. J. L. María, O. C. C. Polo, and T. Elhadary, "An Analysis of the Morality and Social Responsibility of Non-Profit Organizations," FMDB Transactions on Sustainable Technoprise Letters., vol. 1, no. 1, pp. 28–35, 2023.

91. J. Jeganathan, S. Vashist, G. Nirmala, R. Deep, "A Cross Sectional Study on Anxiety and Depression Among Patients with Alcohol Withdrawal Syndrome," FMDB Transactions on Sustainable Health Science Letters,

vol. 1, no. 1, pp. 31–40, 2023.

92. Jerusha Angelene Christabel G, Shynu T, S. Suman Rajest, R. Regin, & Steffi. R. (2022). The use of Internet of Things (Iot) Technology in the Context of “Smart Gardens” is Becoming Increasingly Popular. International Journal of Biological Engineering and Agriculture, 1(2), 1–13.

93. K. S. Kumar, D. Yadav, S. K. Joshi, M. K. Chakravarthi, A. K. Jain and V. Tripathi, "Blockchain Technology with Applications to Distributed Control and Cooperative Robotics," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India, 2022, pp. 206-211, doi: 10.1109/IC3I56241.2022.10073275.

94. K. Venkitaraman and V. S. R. Kosuru, “Hybrid Deep Learning Mechanism for Charging Control and Management of Electric Vehicles”, EJECE, vol. 7, no. 1, pp. 38–46, Jan. 2023.

95. M. Suganthi, and J. G. R. Sathiaseelan, “Image Denoising and Feature Extraction Techniques Applied to X-Ray Seed Images for Purity Analysis,” FMDB Transactions on Sustainable Health Science Letters, vol. 1, no. 1, pp. 41–53, 2023.

96. Mangan, P., Pandi, D., Haq, M. A., Sinha, A., Nagarajan, R., Dasani, T., Keshta, I., & Alshehri, M. (2022). Analytic Hierarchy Process Based Land Suitability for Organic Farming in the Arid Region. Sustainability, 14(4542), 1–16.

97. Nayak, H., Kushwaha, A., Behera, P.C., Shahi, N.C., Kushwaha, K.P.S., Kumar, A. & Mishra, K.K. (2021). The pink oyster mushroom, Pleurotus djamor (Agaricomycetes): A potent antioxidant and hypoglycemic agent. International Journal of Medicinal Mushrooms, Vol.23, No.12, pp.29-36. DOI: 10.1615/IntJMedMushrooms.2021041411

98. P. Pandit, “On the Context of Diabetes: A Brief Discussion on the Novel Ethical Issues of Non-communicable Diseases,” FMDB Transactions on Sustainable Health Science Letters, vol. 1, no. 1, pp. 11–20, 2023.

99. P. Pandit, “On the Context of the Principle of Beneficence: The Problem of Over Demandingness within Utilitarian Theory,” FMDB Transactions on Sustainable Social Sciences Letters, vol. 1, no. 1, pp. 26–42, 2023.

100. P. S. Kuragayala, “A Systematic Review on Workforce Development in Healthcare Sector: Implications in the Post-COVID Scenario,” FMDB Transactions on Sustainable Technoprise Letters., vol. 1, no. 1, pp. 36–46, 2023.

101. P.P. Anand, U. K. Kanike, P. Paramasivan, S. S. Rajest, R. Regin, S. S. Priscila, “Embracing Industry 5.0: Pioneering Next-Generation Technology for a Flourishing Human Experience and Societal Advancement,” FMDB Transactions on Sustainable Social Sciences Letters, vol. 1, no. 1, pp. 43–55, 2023.

102. P.S. Venkateswaran, S. Singh, P. Paramasivan, S. S. Rajest, M. E. Lourens, R. Regin, “A Study on The Influence of Quality of Service on Customer Satisfaction Towards Hotel Industry,” FMDB Transactions on Sustainable Social Sciences Letters, vol. 1, no. 1, pp. 1–11, 2023.

103. Paldi, Robynne L., Arjun Aryal, Mahmoud Behzadirad, Tito Busani, Aleem Siddiqui, and Haiyan Wang. "Nanocomposite-seeded Single-Domain Growth of Lithium Niobate Thin Films for Photonic Applications." In 2021 Conference on Lasers and Electro-Optics (CLEO), pp. 1-2. IEEE, 2021.

104. Priscila, S. S., Rajest, S. S., T, S. and G, G. (2022) “An Improvised Virtual Queue Algorithm to Manipulate the Congestion in High-Speed Network”, Central Asian Journal of Medical and Natural Science, 3(6), pp.

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071
Volume: 5 Issue: 8 | Aug 2023

343-360.

105. R, S., Rajest, S. S., Regin, R., & T, S. (2022). The Obstacles Facing Businesses that are Run by their Families as their Primary Owners. Central Asian Journal of Innovations on Tourism Management and Finance, 3(11), 145-163.

106. R, S., Regin, R., Rajest, S. S., T, S. and G, J. A. C. (2022) "Rail Project's Needed Project Management Approaches, Strategies, Methodologies, and Processes", International Journal on Economics, Finance and Sustainable Development, 4(10), pp. 109-126.

107. R. Oak, M. Du, D. Yan, H. Takawale, and I. Amit, "Malware detection on highly imbalanced data through sequence modeling," in Proceedings of the 12th ACM Workshop on Artificial Intelligence and Security - AISec'19, 2019.

108. R. Regin, Steffi. R, Jerusha Angelene Christabel G, Shynu T, S. Suman Rajest (2022), "Internet of Things (IoT) System Using Interrelated Computing Devices in Billing System", Journal of Advanced Research in Dynamical and Control Systems, Vol.14, no.1, pp. 24-40.

109. R. Steffi, G. Jerusha Angelene Christabel, T. Shynu, S. Suman Rajest, R. Regin (2022), " A Method for the Administration of the Work Performed by Employees", Journal of Advanced Research in Dynamical and Control Systems, Vol.14, no.1, pp. 7-23.

110. Rajest, S. S. ., Regin, R. ., T, S. ., G, J. A. C. ., & R, S. . (2022). Production of Blockchains as Well as their Implementation. Vital Annex : International Journal of Novel Research in Advanced Sciences, 1(2), 21–44.

111. Rajest, S. S., Regin, R., T, S. and R , S. (2022) "The Effect of Corporate Social Responsibility on Organizational Effectiveness", Central Asian Journal of Innovations on Tourism Management and Finance, 3(11), pp. 125-144.

112. Rajest, S. S., Regin, R., T, S. and R, S. (2022) "Organisational Dedication, Employee Contentment on The Job, And Plans to Leave the Organization", Central Asian Journal Of Mathematical Theory And Computer Sciences, 3(12), pp. 5-19.

113. Regin, D. R., Rajest, D. S. S., T, S., G, J. A. C., & R, S. (2022). An Automated Conversation System Using Natural Language Processing (NLP) Chatbot in Python. Central Asian Journal Of Medical And Natural Sciences, 3(4), 314-336.

114. Regin, R., Rajest , S. S., T , S., G, J. A. C., & R , S. (2022). An Organization's Strategy that is Backed by the Values and Visions of its Employees' Families. Central Asian Journal of Innovations on Tourism Management and Finance, 3(9), 81-96.

115. Regin, R., Rajest, S. S., T, S., & R, S. (2022). Impact of Internet Banking on the Efficiency of Traditional Banks. Central Asian Journal of Innovations on Tourism Management and Finance, 3(11), 85-102.

116. Regin, R., Rajest, S. S., T, S., Christabel G, J. A. and R, S. (2022) "The Influence that the Advertising of Pharmaceuticals has on the Economy", Central Asian Journal Of Social Sciences And History, 3(10), pp. 1-18.

117. Regin, R., Rajest, S. S., T, S., G, J. A. C., & R, S. (2022). Pharmaceutical Supply Chain Challenges and Inventory Management. Central Asian Journal of Innovations on Tourism Management and Finance, 3(10), 143-159.

118. Rokicki, T.; Jadczak, R.; Kucharski, A.; Bórawski, P.; Bełdycka-Bórawska, A.; Szeberényi, A.; Perkowska, A. Changes in Energy Consumption and Energy Intensity in EU Countries as a Result of the COVID-19

Pandemic by Sector and Area Economy. Energies 2022, 15(17), 6243. https://doi.org/10.3390/en15176243

119. Rokicki, T.; Koszela, G.; Ochnio L.; Perkowska A.; Bórawski, P.; Bełdycka-Bórawska A.; Gradziuk B.; Gradziuk P.; Siedlecka A.; Szeberényi A.; Dzikuć M. Changes in the production of energy from renewable sources in the countries of Central and Eastern Europe. Frontiers in Energy Research 2022, 10, 993547. https://doi.org/10.3389/fenrg.2022.993547

120. S Silvia Priscila, M Hemalatha, " Diagnosisof heart disease with particle bee-neural network" Biomedical Research, Special Issue, pp. S40-S46, 2018.

121. S Silvia Priscila, M Hemalatha, " Heart Disease Prediction Using Integer-Coded Genetic Algorithm (ICGA) Based Particle Clonal Neural Network (ICGA-PCNN)", Bonfring International Journal of Industrial Engineering and Management Science 8 (2), 15-19, 2018.

122. S. Alayli, "Unravelling the Drivers of Online Purchasing Intention: The E-Commerce Scenario in Lebanon," FMDB Transactions on Sustainable Social Sciences Letters, vol. 1, no. 1, pp. 56–67, 2023.

123. S. Cirillo, G. Polese, D. Salerno, B. Simone, G. Solimando, "Towards Flexible Voice Assistants: Evaluating Privacy and Security Needs in IoT-enabled Smart Homes," FMDB Transactions on Sustainable Computer Letters., vol. 1, no. 1, pp. 25–32, 2023.

124. S. S. Rajest, R. Regin, S. T, J. A. C. G, and S. R, "Improving Infrastructure and Transportation Systems Using Internet of Things Based Smart City", CAJOTAS, vol. 3, no. 9, pp. 125-141, Sep. 2022.

125. Shifat, A. Z., Stricklin, I., Chityala, R. K., Aryal, A., Esteves, G., Siddiqui, A., & Busani, T. (2023). Vertical Etching of Scandium Aluminum Nitride Thin Films Using TMAH Solution. Nanomaterials, 13(2), 274.

126. Srinath Venkatesan, "Utilization of Media Skills and Technology Use Among Students and Educators in The State of New York", Neuroquantology, Vol. 21, No 5, pp. 111-124, (2023).

127. Srinath Venkatesan, "Challenges of Datafication: Theoretical, Training, And Communication Aspects of Artificial Intelligence" Ion exchange and adsorption. Volume 23, Issue 1, 2023.

128. Srinath Venkatesan, "Design an Intrusion Detection System based on Feature Selection Using ML Algorithms", MSEA, vol. 72, no. 1, pp. 702–710, Feb. 2023

129. Srinath Venkatesan, "Identification Protocol Heterogeneous Systems in Cloud Computing", MSEA, vol. 72, no. 1, pp. 615–621, Feb. 2023.

130. Srinath Venkatesan, "Perspectives and Challenges of Artificial Intelligence Techniques in Commercial Social Networks"Volume 21, No 5 (2023).

131. Srinath Venkatesan, Sandeep Bhatnagar, Iván Mesias Hidalgo Cajo, Xavier Leopoldo Gracia Cervantes, "Efficient Public Key Cryptosystem for wireless Network", Neuroquantology, Vol. 21, No 5, pp. 600-606, (2023).

132. Srinath Venkatesan, Sandeep Bhatnagar, José Luis Tinajero León, "A Recommender System Based on Matrix Factorization Techniques Using Collaborative Filtering Algorithm", neuroquantology, vol. 21, no. 5, pp. 864-872, march 2023, doi: 10.48047/nq.2023.21.5.NQ222079

133. Srinath Venkatesan, Zubaida Rehman, "The Power Of 5g Networks and Emerging Technology and Innovation: Overcoming Ongoing Century Challenges" Ion exchange and adsorption, Volume 23, Issue 1, 2023.

134. SS Priscila, M Hemalatha, "Improving the performance of entropy ensembles of neural networks (EENNS)

https://journals.researchparks.org/index.php/IJOT e-ISSN: 2615-8140 | p-ISSN: 2615-7071

Volume: 5 Issue: 8 | Aug 2023

on classification of heart disease prediction", Int J Pure Appl Math 117 (7), 371-386, 2017.

135. Szeberényi, A.; Lukács, R.; Papp-Váry, Á. Examining Environmental Awareness of University Students. Engineering for Rural Development 2022, 21, pp. 604-611. https://doi.org/10.22616/ERDev.2022.21.TF198

136. Szeberényi, A.; Rokicki, T.; Papp-Váry, Á. Examining the Relationship between Renewable Energy and Environmental Awareness. Energies 2022, 15(19), 7082. https://doi.org/10.3390/en15197082

137. Szeberényi, A.; Varga-Nagy, A. Az Ökoturizmus jövője – Összehasonlító elemzés a gyöngyösi diákok körében környezettudatossági aspektusból. Studia Mundi – Economica 2017, 4(5), pp. 73-82. https://doi.org/10.18531/Studia.Mundi.2017.04.05.73-82

138. T, S. ., Regin, R. ., Rajest, S. S. . and R, S. . (2022) "Investigating the Style of Gender Leadership: Male and Female Leadership and Management Style", International Journal of Development and Public Policy, 2(11), pp. 1–17.

139. T, S., Rajest, S. S., Regin, R., Christabel G, J. A., & R, S. (2022). Automation And Control Of Industrial Operations Using Android Mobile Devices Based On The Internet Of Things. Central Asian Journal of Mathematical Theory and Computer Sciences, 3(9), 1-33.

140. V. Nithyanantham, "Study Examines the Connection Between Students' Various Intelligence and Their Levels of Mathematical Success in School," FMDB Transactions on Sustainable Techno Learning., vol. 1, no. 1, pp. 32–59, 2023.

141. V. S. R. Kosuru and A. K. Venkitaraman, "Developing a Deep Q-Learning and Neural Network Framework for Trajectory Planning", EJENG, vol. 7, no. 6, pp. 148–157, Dec. 2022.