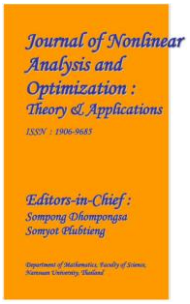
Journal of **N**onlinear **A**nalysis and **O**ptimization
Vol. 15, Issue. 1, No.11: 2024
ISSN : **1906-9685**



IoT-POWER BASED AUTOMATED GARDEN MAINTENANCE SYSTEM

[1]Dr.V.Avinash, [2]MonalisaAcharya, [3]TummanapalliSukanya, [4]DuggapuRohitha, [5]PalavalasaMadhuPreethi, [6] Yandrapu Anithya Mounica Ross

Associative Professor, [1,2,3,4,5,6]Department of Electrical and Electronics Engineering, Vignan's Institute of Engineering For Women,Visakhapatnam,Andhra Pradesh,India

ABSTRACT

Now a days Technology brings remarkable advancement in every field of life, whether it isindustry or agriculture. Over Lives are essentially dependent on agricultural Development where theIOT power-based Automated Garden Maintenances system represents a significant advancement in thefieldofsmartgardeningbyintegratingIOTTechnologytoautomatetheprocess ofwateringplantsinagarden. This innovation system utilizes a combination of sensors, Microcontrollers, communicationsmodules,and automation to ensure efficientand timely plantcare withoutthe need formanualintervention.Heresprinklersarebeenaddedwhereitwasthetime-basedsystemtoensureefficientandcustomized watering in the garden. The Core components of the system include sensors and, a Wi-Fimodemforwirelessconnectivity,whichhelpstotransmitthedataandithelpstocommunicatebetweentheuserandtheplantitwillstorethedatabaseduponagivenprogrammingandtheWi-Fiwilloperateon time.Another sensor was an Arduino UNO sensor for the controller for data transmission andcontrol.ESP32moduleenablescommunicationwiththeIoTplatformfordatatransmissionandcontrol.Solenoids are used to control the flow of water using an electromagnetic coil. Users set schedulesthroughanapp,promotingwater conservationwhilemaintainingoptimalplanthealth.Thisstreamlinedapproachsimplifiesmaintenance,showcasingthefusionoftechnologyandsustainabilityingardencare.

I. INTRODUCTION

Nowadays, automation governs everything. It is a technique of using computers or mobile phones inmonitoringandcontrollingthesimpleparametersofday-to-daylife.Thepracticeofautomatingroutinetasks will raise our standard of living. By utilizing the Internet of Things, we are able to createinterconnected sensors that have great automation potential. This prototype's ability to cut costs andguarantee safety is crucial. People were cautious in their maintenance when they first started trying tomake plantings and set up their own gardens. As days go on due to lack of maintenance the plants getdestroyed. People will be able to automatically monitor the parameters and ensure maintenance withthe aid of this prototype. IOT solves a lot of issues and makes things in network infrastructure able tobesensedorcontrolledremotely.Itisanessentialcomponentandasmartallyforplants.

II. LITERATURESURVEY

The article titled "IoT Power-Based Automated Garden Maintenance System with Time-Based WaterSprinkles" by Jasmine Sweety. A S. Dharshika, J. Jabez and V. Maria Anu, discusses an IoT-basedsystem that automates garden maintenance. The system monitors plant growth and conserves waterthrough smart irrigation techniques. It allows users to remotely control watering schedules withoutusingsoilmoisturesensorsandtemperaturemonitoring.Whileitmaynotbeasspreciseassensor-basedsystems,thisIoTsolutionoffersasimpleyeteffectivemethodforgardencareneeds.

ByusingIoTtechnology,thissystemenablesreal-timemonitoringandadjustmentofwateringpatternsbasedonenvironmentalconditionsandplantrequirements.It maynotprovidethesamelevelof

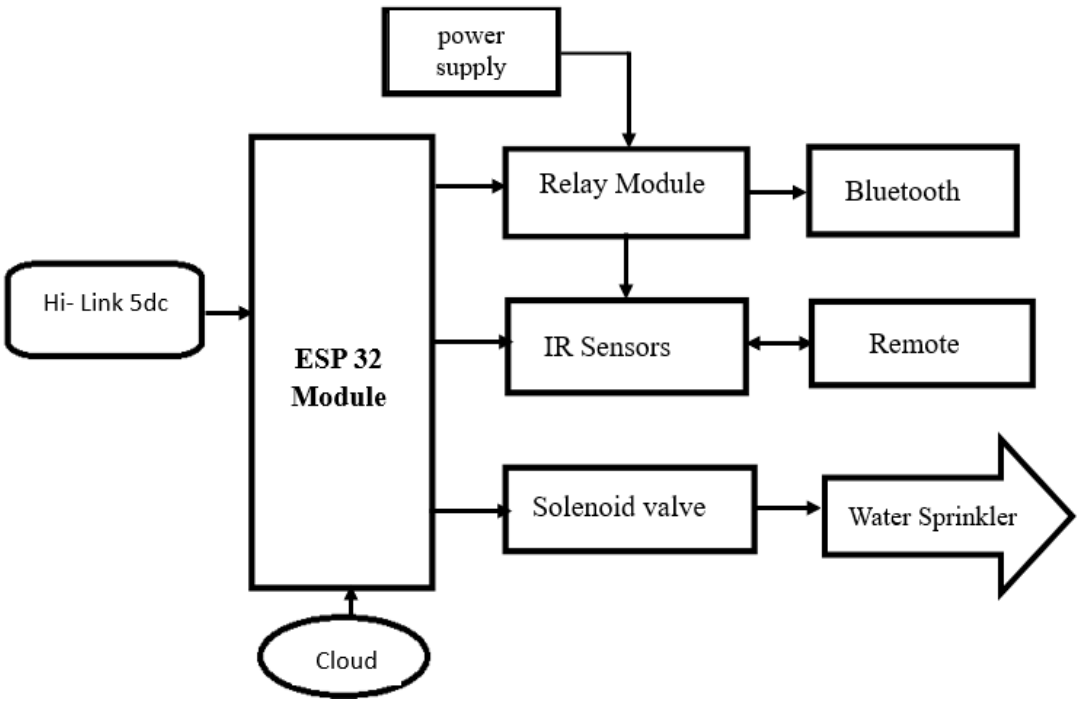
http://doi.org/10.36893/JNAO.2024.V15I1N01.349-357

precision as sensor-based systems, but it simplifies garden maintenance and promotes healthier plantgrowth.Theintegrationofsensors,connectivity,andsmartalgorithmhancestheefficiencyofwat eringpractices,makingitavaluableassetformoderngardeningapplications.

III. PROPOSEDSYSTEM

TheProposedSystemdescribedmainlyconsistsofanESP32module,whichservesasamicrocontroller controlling the smart garden setup. This ESP32 module is connected to a relay module, which plays
acrucialroleindetectingsignalsandoperatingthesystembyactingasaswitch.TheESP32microcontrol lerfacilitatesthemonitoringandcontrolofvariousparametersinthegarden,suchaswaterlevels, while the relay module enables the activation of different components like water pumps andother devices based on sensor readings. This setup allows for remote monitoring and control of thegarden through a mobile application or web dashboard, providing users with the ability to efficientlymanagetheirgardenwithoutconstantphysicalintervention.Additionally,IRsensorsareint egratedwithboththeESP32andrelaymoduletodetectinfraredlight,facilitatingremotecontrolofthesy stemusinga remote. Solenoids are also part of the setup to regulate fluid flow, particularly for activating watersprinklers. An Android application developed with Android Studio software allows users to monitorparameters remotely. Cardio app development allows the user to operated the system using the Wi-Fi.Userscaninitiatethewateringprocessthroughaswitchintheapplication,ensuringefficientmainten anceof the gardenthroughautomation.

IV. BLOCKDIAGRAM



V. EXISTINGSYSTEM

Maintaininghealthyandgrowingplantscanbedifficultwhenindividualsneglecttoirrigatethemwhile going about their everyday business. These days, where we should be using the water effectively, weobserve a shortage. The existing system basic garden watering system without

iot technology relies ontraditionalsprinklersystemforwatering,lacksthatadvancedautomationandsmartfeaturesoffered byIoT-basedsystems.Intraditionalsetup,manualinterventionisrequiredforwateringthegarden,makingthe processmore labor-Intensive and less efficient. Recognizing the challenges and limitations of thecurrent system,thedecisiontoenhanceitwithIOTtechnologyaims toimprovethewateringprocess,automated garden maintenance, and optimize water usage. Creating a comprehensive IoT-

poweredautomated garden maintenance system with a time-based water sprinkler involves integrating variouscomponentsandfunctionalitiestoensureefficientplantcareandresourcemanagement.Thisinn ovativeusers with remote control and monitoring capabilities for their gardens. The existing IoT-poweredautomated garden maintenance system with a time-based water sprinkler offers a comprehensivesolution for efficient garden care. By integrating technology with plant care practices, this systemenhances plant growth, conserves resources, and simplifies maintenance tasks for users, making it avaluableassetformoderngardening.

ESP32 MODULE

TheESP32moduleisaversatilemicrocontrollerdevelopedbyExpressifSystems.Itfeaturesdual-coreprocessing, Wi-Fi, and Bluetooth connectivity, making it ideal for IoT projects. With a rich set ofperipherals including GPIO pins, SPI, I2C, UART, ADCs, and DACs, it offers flexibility for a widerange of applications. Its low power consumption makes it suitable for battery-powered devices.Programmed using various frameworks like Arduino IDE, MicroPython, or ESP-IDF, it's accessible todevelopers of all skill levels. Widely used for IoT, wearable tech, and embedded systems, the ESP32modulestandsoutforitsperformance,connectivity,andeaseofuse.

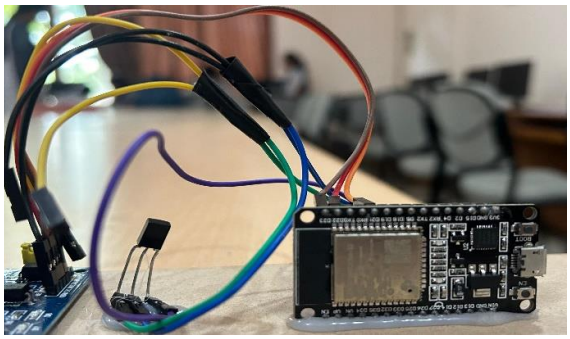


Fig: ESP 32 Module

RELAY MODULE

Arelaymoduleisanelectromechanicaldevicethatallows youtocontrolhigh-powerelectricaldevicesusing low-powersignals from microcontrollers,such as Arduino,Raspberry Pi,or othersimilarplatforms.Itessentiallyactsasaswitchthatcanbecontrolledelectronically.Therelaymodulec ontainsa coil that, when energized, generates a magnetic field. This coil is what controls the switching actionof the relay. it's pivotal for remote control and automation in diverse applications.

Its interface ensuresease of use, allowing seamless integration with different projects, while enhancing safety by providinga barrier between the control circuit and high-power components. Whether for home automation,industrial systems,orprototyping,relaymodulesoffera reliable solution,empowering userstoefficiently manage electrical loads while mitigating risks associated with direct control of high-powercircuits.

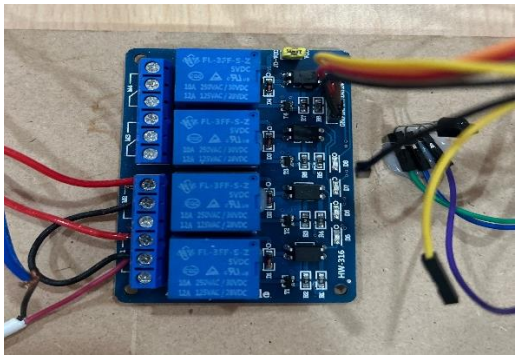


Fig 2: Relay Module

SOLENOIDVALVE:

Asolenoidvalveis anelectromechanicaldeviceusedtocontroltheflowoffluidsorgases inasystem.It consists of a coil of wire (solenoid) surrounding a movable plunger inside a valve body. When anelectricalcurrentisappliedtothesolenoid,itgeneratesamagneticfieldthatattractstheplunger,causingitt omoveandopenorclosethevalve.Thisactionallowsforprecisecontroloverthefluidorgasflow,making solenoid valves essential in various applications such as irrigation systems, pneumatic andhydraulicsystems,gascontrolinindustrialprocesses,andautomotiveapplications.

Fig3:SolenoidValve

IRSENSORS:

Infrared (IR) sensors detect infrared radiation emitted or reflected by objects. They consist of an IRtransmitter and receiver. The transmitter emits IR light, which bounces off objects and is detected bythe receiver. When an object comes within the sensor's range, the received IR radiation changes,triggering the sensor. IR sensors are used in various applications like proximity sensing, motiondetection,andobjecttracking.They'recommonlyfoundinsecuritysystems,automaticdoors,robot ics,and smart devices. With their non-contact nature and ability to work in various lighting conditions, IRsensors providereliabledetectionandcontributetoautomationandsafetyinnumerousenvironments.

http://doi.org/10.36893/JNAO.2024.V15I1N01.349-357

Fig4:IRSensors

WATERSPRINKLER:

A rotating water sprinkler is a device used for watering gardens, lawns, and agricultural fields. Ittypicallyconsistsofabaseconnectedtoa watersourceandarotatingarmornozzleassembly.Aswaterflowsthroughthesprinkler,it impartsforcetotherotating mechanism,causingit tospinanddistributewater in a circular pattern. This even distribution ensures efficient coverage of the area being irrigated,promotinghealthyplantgrowth.Rotatingsprinklerscomeinvariousdesigns,includingoscillating and gear-driven types, and are often adjustable to control the spray radius and intensity, making themversatileandessentialtoolsforirrigation.

Fig5:RotatingSprinkler

VI. SOFTWARETOOLS:

ARDUINO:

The program for NodeMCU can be written in any programming language. The Arduino softwareprovides a better Integrated Development Environment (IDE) for programming the NodeMCU. It is across-platformapplicationwritteninJava.Thissoftwareconsistsofvariousfeatureswhichincludecodeeditor, text cutting and pasting, replacing text and searching, brace matching, automatic indenting, andsyntax highlighting. The board in the software should be changed to NodeMCU from Arduino and thelibraries for NodeMCU should be included in the software. The board is tested with a blinking LEDprogramandtheprogramforthesmartgardeniswritten.Thelibraryfilesforfirebaseconnectivityisincludedintheprogram.Theprogramknownasthe sketchissavedwithfile extension.

http://doi.org/10.36893/JNAO.2024.V15I1N01.349-357

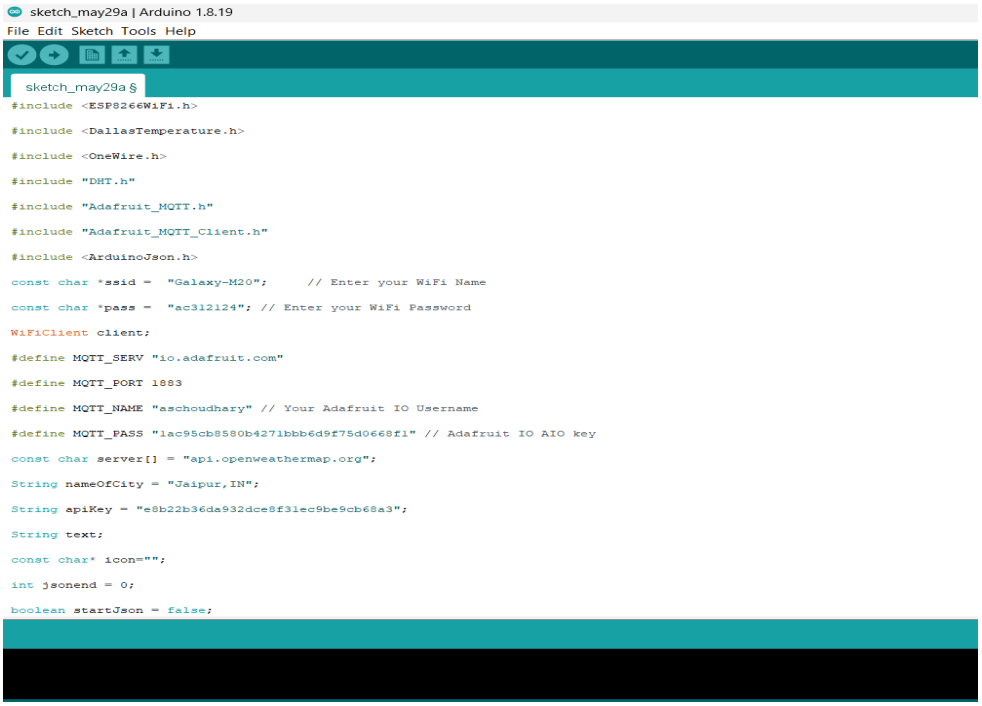


Fig6:SoftwareTesting UsingArduinoApp

VII. IMPLEMENTATION AND RESULT:

CADIOAPP:

A cardio app is a mobile application designed to track and improve cardiovascular health. It typicallyoffersfeatureslikeheartratemonitoring,workouttracking,andpersonalizedfitnessplans.So mecardioapps also provide guided workouts, coaching tips, and integration with wearable devices for seamlessdata synchronization. With user-friendly interfaces and comprehensive features, cardio apps empowerindividuals to achieve their fitness goals, improve heart health, and lead a more active lifestyle, allconvenientlyfromtheirsmartphones.

Herearesomefigureswhichshows theresultoftheproject.

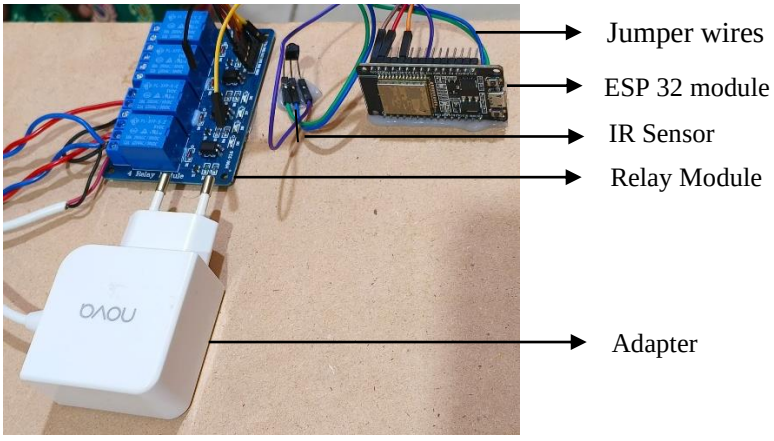


Fig 7: Hardware Implementation

http://doi.org/10.36893/JNAO.2024.V15I1N01.349-357

Fig 8: Gardening Maintenance through IoT

CONCLUSION

An IoT-powered automated garden maintenance system with time-based water sprinkling offers convenience and efficiency for gardeners. By leveraging IoT technology, users can remotelycontrol watering schedules and ensure their plants receive adequate hydration. While the system maylacktheprecisionofsoilmoisturesensorsandtemperaturemonitoring,itstillprovidesaviablesolutionfor basic garden care needs. With further advancements in sensor technology and data analytics, futureiterationsofthesystemcouldenhanceaccuracyandcustomization.Overall,theIoT-poweredautomatedgardenmaintenancesystempresentsapromisingavenueforsimplifyinggardeningtasksandpromotinghealthyplantgrowth.

FUTURESCOPE

The IoT Power-Based Automated Garden Maintenance System represents a significant advancement in modern gardening practices. By leveraging IoT technology and power-based automation, this projectoffersacomprehensive solution formaintaininggardenswithminimalhuman intervention. Theintegration of sensors, actuators, and a centralized control system enables efficient monitoring andmanagement of various parameters such as soil moisture, temperature, and light levels. This not onlyoptimizes resource utilization but also promotes plant health and growth. Furthermore, the system'sremote accessibility via mobile or web interfaces empowers users with real-time insights and controlover their garden, regardless of their physical location. Overall, the IoT Power-Based AutomatedGardenMaintenanceSystemshowcasesthepotentialoftechnologytorevolutionizetraditionalgardeningmethods,makingthemmoreefficient,sustainable,anduser-friendlyintoday'sinterconnectedworld.

REFERENCES

[1]. P.M. Pawar, S.D Pawar, J.A. Vare, “Public Garden Automation System,” Journal of Information,KnowledgeandResearchinElectronicsandCommunicationEngineering,vol. 04, 2018.

[2]. T. Thamarai Manalan, S. P. Vivek, G. Satheesh Kumar and P. Saravanan, “Smart Garden MonitoringSystemUsingIOT,”AsianJournalofAppliedScienceandTechnology(AJAST),vol. 02, 2018.

[3]. A. Jasmine Sweety, S. Dharshika, J. Jabez and V. Maria Anu, “An Enhanced Automation of GardenWateringBasedonIOT,”GlobalJournalofPureandAppliedMathematics,No.6,vol. 13, 2017.

[4]. M.H. Abd-Elhamed Khalid and Dr. H. Eltaher Mohamed, “Public Garden Automation,” International Journal of Engineering, Applied and Management Sciences Paradigms, vol. 44, Issue 01, 2015.

[5]. V. Ankit, R. Harsh, J. Gaurav, "Automatic Gardening System Using Arduino," SSRG International Journal of Electronics and Communication Engineering (SSRG-IJECE), Vol. 3 Issue 8, 2016.
[6]. M. Nagaraj Pandian, U. Ram Prasanth, G. Selva Kumar, S. Tamil Selvan, "Automatic Irrigation System on Sensing Soil Moisture Content," INTERNATIONAL Journal of Innovative Research In Electrical, Electronics, Instrumentation And Control Engineering, vol. 3, Issue 1, 2015.
[7]. Mr. M. Vilas, Mr. M. Sagar, Mr. I. Gaurav and Prof. D. S. Gawali, "PUBLIC GARDEN AUTOMATION USING GSM TECHNOLOGY," International Journal for Research Trends And Innovation, vol. 2, Issue 3, ISSN: 2456-3315.
[8]. A. Rajpal, S. Jain, N. Khare and A. Shukla, "Microcontroller based Automatic Irrigation System with Moisture sensors," Proc. of the International Conference on Science and Engineering (ICSE), RG Education Society press, pp. 94-96, 2011.
[9]. M. Vilas, M. Sagar, G. Ingale and G. Gawali, "Public Garden Automation using GSM Technology," International Journal for Research Trends and Innovation, vol. 2, Issue 3, pp. 100-102, 2017.
[10]. S. Gowri and G. Divya, "Automation of Garden tools Monitored using Mobile Application," International Conference on Innovation In formation in Computing Technologies (ICIICT), Chennai, India, IEEE press, 2015, doi:10.1109/ICIICT.2015.7396084, AMSE 2021 Journal of Physics: Conference Series 2089 (2021) 012062, IOP Publishing doi:10.1088/1742-6596/2089/1/0120627.
[11]. A. Vashista, H. Rathore, G. Jain, "Automatic Gardening System using Arduino," SSRG International Journal of Electronics And Communication Engineering (SSRG-IJECE), vol. 3, pp.119-120, 2016.
[12]. N. Binti Arbain and M. Dan Darrawi bin Sadli, "An IoT based Smart Garden with Weather Station system," 9th Symp on computer Application & Industrial Electronics (ISCAIE), IEEE Press, pp. 38-43, doi: 10.1109/ISCAIE.2019.8743837, 2019.
[13]. M. Sambath, M. Prasant, N. Bhargav Raghava and S. Jagadeesh, "IoT based Garden Monitoring System," International Conference on Physics and Photonics Processes in Nano Sciences, IOP Publishing LTD press, doi:10.1088/1742-6596/1362/1/012069, 2019.
[14]. Ö. Alpay and E. Erdem, "Climate Control of Smart Greenhouse based on Android," In 2018 International Conference on Artificial Intelligence and Data Processing (IDAP), pp. 1-5, 2018.
[15]. S. Bhardwaj, S. Dhir and M. Hooda, "Automatic plant watering system using IoT," In 2018 Second International Conference on Green Computing and Internet of Things (ICGC, IoT), pp. 659-663, 2018.
[16]. M. Camps-Calvet, J. Langemeyer, L. Calvet-Mir and E. Gómez-Baggethun, "Sowing resilience and contestation in times of crises," The case of urban gardening movements in Barcelona, 2015.
[17]. G. Carrión, M. Huerta, and B. Barzallo, "Internet of things (IoT) applied to an urban garden," In 2018 IEEE 6th International Conference on Future Internet of Things and Cloud (Fi Cloud), pp. 155-161, 2018.
[18]. G. Codeluppi, A. Cilfone, L. Davoli, and G. Ferrari, "Veg IoT garden : a modular IoT management platform for urban vegetable gardens," In 2019 IEEE International Workshop on Metrology for Agriculture and Forestry (Metro Agri For), pp. 121-126, 2019.
[19]. R. Dagar, S. Som and S.K. Khatri, "Smart farming–IoT in agriculture", In 2018 International Conference on Inventive Research in Computing Applications (ICIRCA), pp. 1052-1056, 2018.
[20]. V. Deshpande, S. Gharat, P. Firke and S.S Rathod, "Real Time Plant Watering System," Asian Journal for Convergence in Technology, vol. 5(2), 2019.
[21]. D. Divani, P. Patil and S.K. Punjabi, "Automated plant Watering system," In 2016 International Conference on Computation of Power, Energy Information and Communication, pp. 180-182, IEEE, 2016.
[22]. R.S. Ferrarezi, S.K. Dove and M.W. Van Iersel, "An automated system for monitoring soil

moisture and controlling irrigation using low-cost open-source microcontrollers," Hort Technology, vol. 25(1), pp.110-118, 2015.

[23]. M.I.H. Ismail and N.M. Thamrin, "IoT implementation for indoor vertical farming watering system," In 2017 International Conference on Electrical, Electronics and System Engineering, pp. 89-94, 2017.

[24]. L. Kamelia, M.A. Ramdhani, A. Faroqi, and V. Rifadiapriyana, "Implementation of automation system for humidity monitoring and irrigation system," In IOP Conference Series: Materials Science and Engineering, vol. 288, 2018.

[25]. R.K. Kodali and A. Sahu, "An IoT based soil moisture monitoring on Losant platform," In 2016 2nd International Conference on Contemporary Computing and Informatics, 2016.

http://doi.org/10.36893/JNAO.2024.V15I1N01.349-357