International Journal of Future Generation Communication and Networking
Vol. 14, No. 1, (2021), pp.1692–1704

An Utilization Of Robot For Irrigation Using Artifical Intellegnece

[1] Dr. N.Vasantha Gowri., [2] Dr. Mohd Naved., [3]Dr.Purnendu Shekhar Pandey., [4]Dr Ashim Bora.
[1]Assistant Professor, Electrical and Electronics Engineering, Chaitanya Bharathi Institute of Technology (A), Gandipet, Hyderabad, Telangana 500075.
[2]Assistant Professor, Department of Business Analytics, Jagannath University, Delhi-NCR, India
.[3]Associate Professor, Department of Computer Science & Engineering ,Koneru Lakshmaiah Education Foundation (KLEF), Greenfields, Vaddeswaram, Guntur-522502
[4]Associate Professor and Head, Department of Mathematics. Diphu Government College, Diphu. Assam.
[1]vasanthagowri_eee@cbit.ac.in,[2]mohdnaved@gmail.com, [3]purnendu.pandey@kluniversity.in, [4]ashim.bora@rgu.ac.in

Abstract
Irrigation systems are just as ancient as human beings, because farming is a civilized civilization's main profession. It is an insurmountable challenge to irrigate big planting regions. Various irrigation planning systems, particularly are mostly focused on soil, vegetation and predictive maintenance, were already established to solve this challenge. Irrigation planning covers whether irrigation is necessary as well as how much water is to be used. Resulting from environmental circumstances, fluid should be supplied to plants. Each plant also starts to improve varying quantities of water. We thus have developed a robot dubbed the watering robot for the plant. This robot monitors agricultural or planting soil relative humidity When the quantity of groundwater is less about 30%, it signifies that the surface is drying, then liquid quickly passes and the ocean levels climb to 100%. This work proposes artificial smart controllers for efficient irrigation programming and provides an Automated Quantum Computing Watering System that can independently water regions utilizing measurements. Within the method suggested, the farmers utilizing Artificial Intelligence need to get the updated information inside this domain of irrigate from the producer who really is present on a separate site than just the farmer. The mechanism drains the rain energy as well. Certain methods reduce the overuse of water, insecticides, preserve the agricultural production, and also assist to use personnel efficiently, increase production and enhance durability.
Keywords: *Irrigation System, Plant Watering Robot, Artificial Intelligence.*

1. Introduction

85 percent of the world largest water availability are used by farming, however because of urban sprawl and a growing need for sustenance the above proportion will continued dominating methane emissions. Because of the very low available water reserves and even the availability of teachers we have improved our equipment and developed many various methods of water usage in agriculture. In order to optimise wheat output and efficiency of freshwater consumption in relation to weed management regarding the soil assessment, water pump planning has been repeatedly proved to be effective. The assessment of plant evaporative cooling is an innovative measure to assess irrigation requirements (ET). ET affects meteorological parameters such as direct sunlight, warmth, moisture, wind direction, soil composition, management components, soil qualities, pests, and antibiotic resistance. ET is impacted by wind velocity, wind velocity as well as crop variables. [1].

An surge has occurred over the years in computational methods notably in heath, meteorological, nuclear technology, robotics, agriculture, etc.[5]. More over half of the people worldwide is interested in farming. AI for farming, economic marketing efforts, wind patterns and time of the release is implemented in the field of farmland. Farmers benefit from AI and increase yield in comparison to conventional agricultural methods.[2]. In

ISSN: 2233-7857IJFGCN

livestock agriculture, the irrigation demands of a product were discretionary, and its output depended heavily on global climate factors [17]. The creation of the mechanical revolution. The main of farming methods helped landowners' terrible lives. But that's still a employment and monsoon-dependent practice [2]. Telecommunications architecture is hugely common mostly in autonomous area. It is advancing robotics. The robot was manufactured aluminum frame for high strength and movement is made of iron. The rear wheels have quite a distinct power train to good grip upon that ground and indeed the tires include designs to improve their grip. The circumference of the spindle (10cm). The goal of its robot frames is to preserve the gravitational pull that ensures robot balance in inclined regions. The robot has 5L assisting users and even a 12vdc compressor is used for force pounding on a specific place to fling the liquids. An automated water faucet system has also been devised to determine the flow stream exit. When the robot encounters dry soil, your computer is sent a signal immediately fill in all the water necessary. The microcontroller thereby provides signal toward the operators of the machine [3].

The engines are linked and the machine forces water to either the ground or plants and proceeds. If any obstacle occurs then the sunlight is export control in almost any position, and after that the machine examines the directions (right or left) on the fastest distance. The robot connects in auto mode with a smart phone and moves all independence. The pot is open regular groundwater at 4 degrees. The infrared leftovers sensor is used to detect the vessels for drink refilling on the back shoulder. So many little parts are designed of aluminums and the machines and frying machines chop and trimmed. The nodes receive a soil detection technique under and over using the 12vdc engine. The robot seems to have a strong friction proportioning valve [4].

Any dwelling or garden is a pleasant bonus. Sunglasses offer color and intriguing forms to a drab area at least. A research carried out by NASA and also the Affiliated Builders of Landscaping of America during the late 1980s produced good news for households and office employees throughout the world. Regrettably, due to inadequate hydration, numerous seedlings perish every year. We saw all the dark, dry leaves falling off. Nowadays, because of their busy living, homeowners either neglect to require control of these valuable goods or simply have no money to interact with their irrigation requirements. Whether stagnating and not movable, the hydration methods involved till now are quite expensive. Throughout this scenario the "animatronics drone for flower washing" is going to work in order to solve these problems in a convenient manner [3].

2. Review of Literature

Wall and King [7] the moisture content of the soil and variable management shower produced an automatic, practice area composting toilet. Those technologies does n’t take this into account waterborne diseases surveillance in bodies of water, nor do they take into mind the idea of M2M connectivity. Research was undertaken on the development of a global, identity intense touch screen drainage system.

Kumar (2014) [8] Examines the important desalination plants with the chief reason for building a scheme that requires less resources and enhances performance. In order to evaluate soil health, instruments such as childbearing meters and PH meters are established on the area to measure their percentages of soil's key elements such as lithium, phosphate, ammonia. Remote irrigated technique for irrigation systems plants autonomous desalination plants are installed on the field. This guarantees that the ground is fertile and that water resources are efficiently used.

Pravin Kshirsagar et al[14[15][16][17][18][19][20] has Several nerve connections have been established in order to fulfill their objectives, such with one layer activating capabilities, multilayer experiences, Rbf, Ffnn, Pnn, Grnn, etc.. This conventional computer program was believed to be suitable for a restricted range of moderate run-times data and configurations. However, with digitized technology developments the number of data being processed and even the duration for execution of the design phase are reduced. Many academics have therefore modified conventional machine learning, which can accept a lot of input and then have less time to

ISSN: 2233-7857IJFGCN

converge[21][22][23][24]. The impacts of complex and fake websites may be described or generated via biological systems.

Mrs.T.Vineela,,J.NagaHarini,,Ch.Kiranmai, G.Harshitha and B.AdiLakshmi, [9] Developed Wireless farm observation and intelligent irrigating system employing Raspberry PI, that used a surface humidity sensor to be continuously implanted in the soil. It transmits the Raspberry Pi actual information. It is extremely ineffective since several instruments are needed and because the morphology of the chemical weathering with the germination of seeds, the monitors are disrupted.

Sotiris Nikoletseas and Georgios [3] which was also developed in 2011[5] This solution water flowerbeds utilizing monitors and watering them with the associated nozzles by assessing current plant growth. This technique is difficult because it is not movable; the faucets are still linked to the house plant which spoils the attractiveness of the surroundings. In addition each dining table positioned beneath has independent monitors and irrigation valves whose, as the numbers of flower pots rises, increasing the performance of the product.

Varatharajalu and Ramprabu (2018)[10], Two parameters were constructed to monitor the moisture levels of the ground for distinct causes, such as the water pump, the humidity sensor enabling heat detection, the water pump monitor for keeping pressure and indeed the biochemical sensing for improved cultivation. Analogue security cameras. All the instruments are transformed into message data and transferred across the wireless communication to the multiplexing.

3. Smart Irrigation

3.1 Irrigation Techniques

The most essential measures to counteract any impact on marine life that increasing amount of organic might have are effective use of groundwater. Many irrigation systems lower the freshwater delivered per unit of generated biomass, hence boosting irrigated effectiveness irrespective of the soil types.

3.1.1. Advanced Irrigation Scheduling

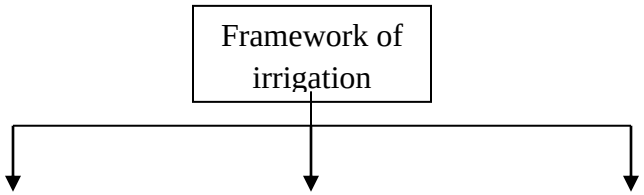
A combination of environmental quality that is maintained and connected to the grid paneling but through a wirelessly railway system enables farmers to track weather patterns on an everyday or a weekly level and to strategically irrigate regions. For instance, if it rains, a farmers can keep irrigation away [1].

3.1.2. Conservation Tillage

With the use of a cropping soil amendment, companies have managed to change this same root system of a plant, to increase the soil nutrients flow ability and lower the relative humidity, which lessens the loss of evaporated moisture. [1].

3.2 Factors influenced In Irrigation system

Intelligent farming enables directly from the farmers returns using minimal groundwater, fertilizers and seedlings. Farmers may use sensors to analyze their plants, conserve natural resources and lessen the environmental impact of crops. Smart farming is also known as precision farming. A range of good durability are often used to analyze and optimize vegetables in agricultural productivity, and to also adapt them to continuously changing elements such as sensors, break beat sensors, mechanically actuators, groundwater actuators, ventilation actuators, commercial satellite data, pressure sensor, accelerometers and pH-sensors. The Figure 1 illustrates the factors influenced irrigation system.



ISSN: 2233-7857IJFGCN

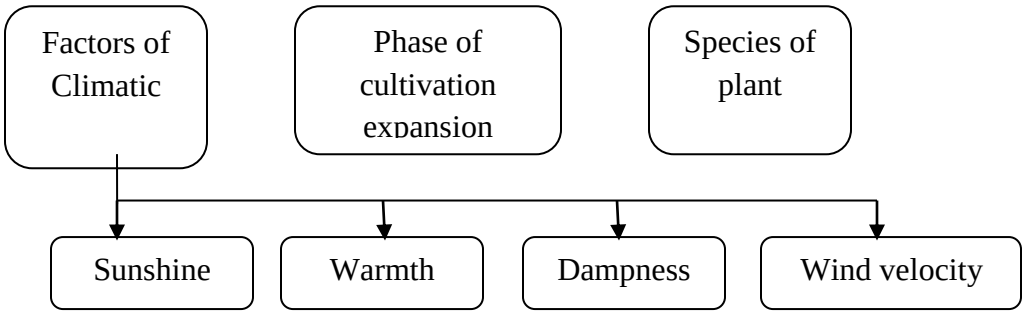


Figure 1: Factors influenced Irrigation system

Several of the key sensor is really the gas concentration detector in precision farming. The cubic water absorption (humidity) in the soil is measured using this method. The target value is set and even the level of environmental humidity monitored and checked with that and under input parameters. The moisture sensors are used for the warmth and percentage humidity in the air. The ratio of real water temperatures to the maximum quantity of water that may be retained in this atmospheric pressure is humidity. Water is an essential requirement for farming, with three traditional techniques of irrigated: irrigation stream irrigated agriculture, sprinklers and drainage systems [5].

3.3 Block Diagram of Smart Irrigation System:

The water supply valve of your tank is regulated mechanically by a soil moisture sensor circuitry there in independent customer package. The transmitter is positioned on the ground where another crop is grown. The relative humidity there in soil is converted into the same energy by the sensors. The detecting circuit features a voltage output, whereby the farmer may modify to set various degrees of humidity for different plants. The levels of soil wastewater generated is related to the distinction between the two polarities. A stepper engine with rotating angle proportionate to the electric current has been provided a servo controller[14]. The stepwise engine regulates the bridge area including its valve, which regulates the water pressure. The power output is thus equivalent to the distance in dryness. As shown in figure 2

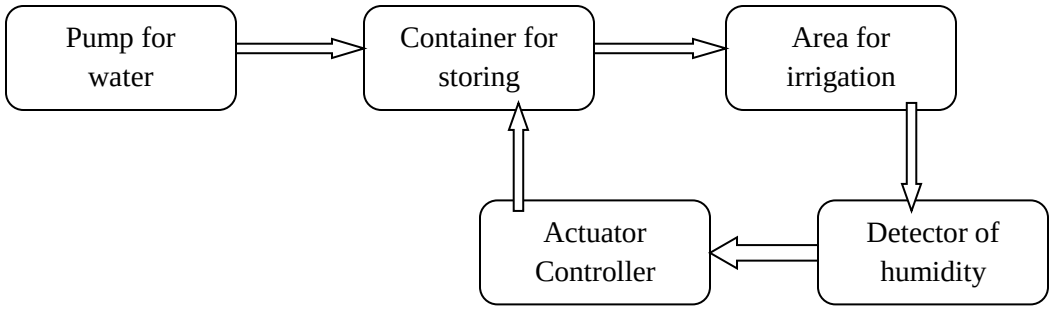


Figure 2: Block Diagram of Irrigation System

3.4 Energy-Efficient Irrigation System

Managed services that combines renew space smart renewable technologies with irrigation as depicted in Figure 3 to reduce costs for irrigation. The system has relevant documents and a shared bus interconnected to six

ISSN: 2233-7857IJFGCN

dimensions, including irrigation elements, energy-saving and manufacturing equipment, energy generation, energy industry and supplemental subsystems.

The major purpose of building this method is to analyze how household and commercial loads may be handled by rechargeable and energy sources. As seen in Figure 3, five important features of your devices being interconnected coach called an ICB Each module contributes to the drip irrigation with its intended purpose. The electric power to everyone in the institution is the responsibility of the power transmission module. The entire energy transfer of various nodes is calculated using the capacitor voltage. The electric component is essential for the delivery of several existing energy equipment, i.e. motors, turbines, Solar panel and storage. The Energy consumer solution offers potential energy-saving equipment, for example existing homes home appliances and corporate appliances, which may be classified into two groups. The financial system organizes power offers among suppliers and users. The platform's primary element, i.e. the water component, may irrigate plants in two modes, namely automatic and inactive. Its platform's supplemental module contains all other multiplier world, such as heating elements, soil temperature and pressure sensor.

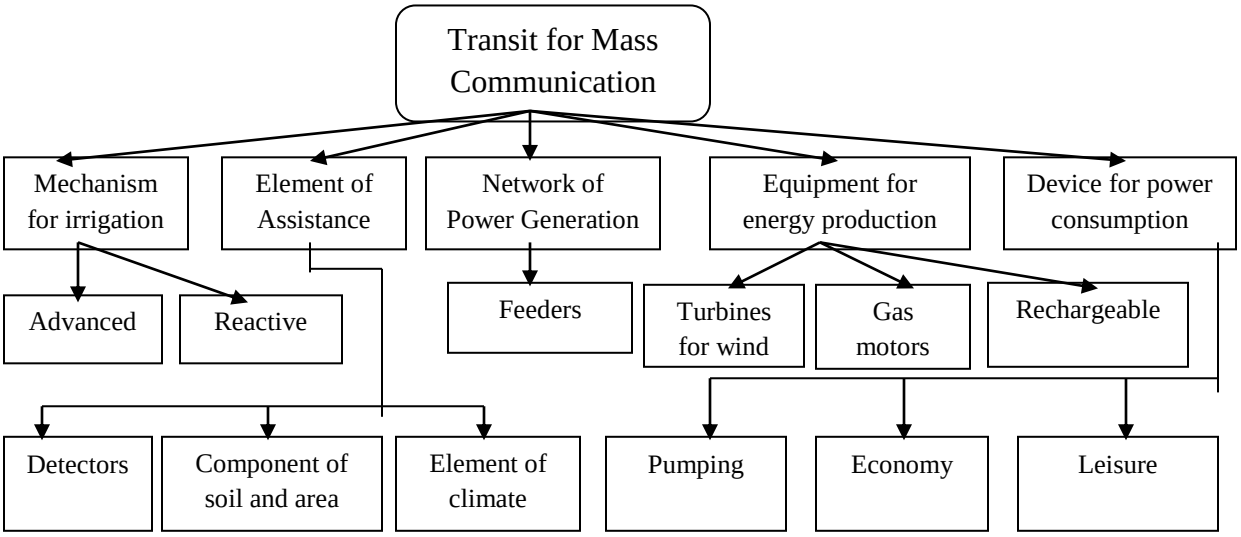


Figure 3: Energy-Efficient Irrigation System

3.4.1 Irrigation monitoring system:

This system is comprised of two layers: continuous phase and upper surface as illustrated in Figures 4. Irrigation control system. The modular sensed data is deployed on the lower layer whereby units are put inside wide-ranging groups. The terminals transmit data toward the Wireless Connection linked cell tower that contains the gps receiver applications.

The top layer has 5 modules: 'collection panel, device for network administration, module for an alert system present status and commerce module.' Genuine and semi information is gathered via data collection components saved for judgment alerts from sensor networks in the repository. An Alert system status mentally prepare is used to display alerts or statistics for the later part. The displays component Alarm/Network information functions as a point of contact among end consumers and many other components / networking [7].

Approval of crop fields to irrigation, fertilizer and insecticide applications. A field monitoring system centered on even a sensor was created in order to install solar damp terminals and different resolutions camera. For comparison assessment and comparison, the material from both sources is gathered. Harvest width, saturation and

ISSN: 2233-7857IJFGCN

vegetation statistics are transmitted via self-contained, identity camera via the Access Point (BS) IoT systems. In particular, the time is allocated for crop photographs from some of these cameras nodes. Finally, components of something like the camera may be used to analyze your cattle placement and behavior [13].

An automated (A2S) dynamic spectrum watering system. Security systems are used for fertilizer application planning and evaluation. The comment thread leadership regulates the network topology and offers farmers with PDA service [7] appropriately. Extended separation between both the sensor nodes and the server is offered in this approach. Databases, program and http server administrative modules. The software system that is housed on a computer system receives information from sensors.

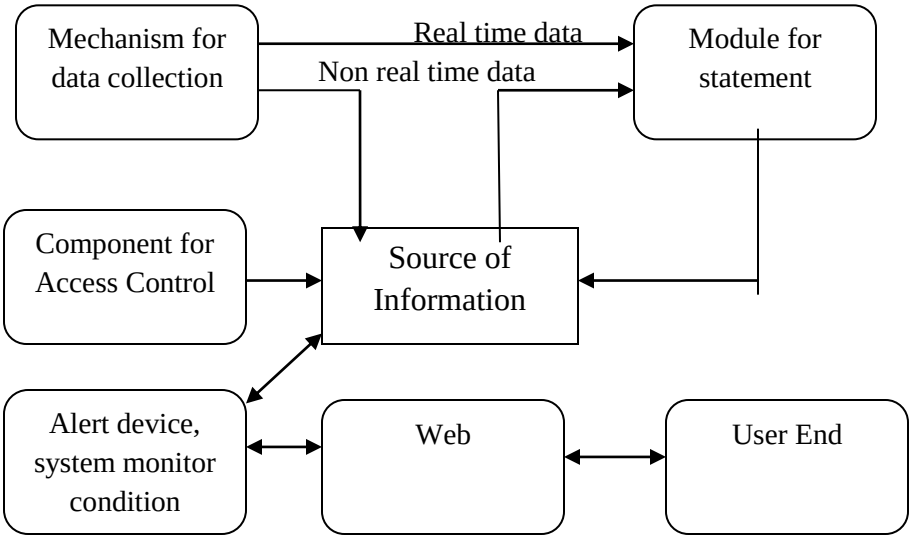


Figure 4: Irrigation monitoring system

3.5 AI based Irrigation Control System

Figure 5 exhibits the block diagram of Complete Irrigation System ingrained with ANN Controller. It is seen that control system consists of four interconnected stages[15].

3.5.1 Input from Sensors:

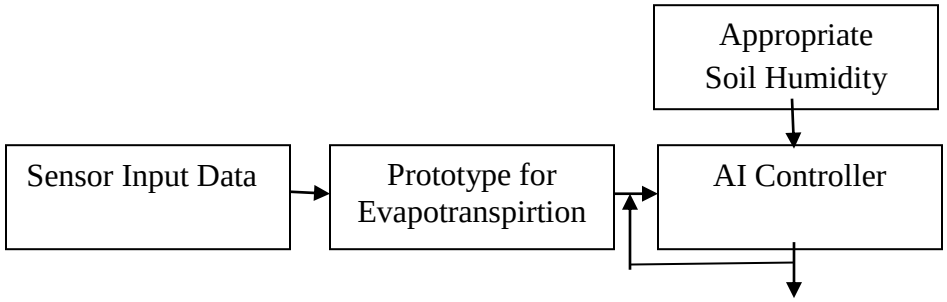
Different metrics are gathered at this step, such as warmth, humidity, vegetation cover, velocity and irradiation. These characteristics are then supplied as output to the following stage..

3.5.2 Evapotranspiration Model:

This block converts input parameters into actual soil moisture

3.5.3 Required Soil Moisture:

The block contains data on the number of water needed to grow vegetation correctly.



ISSN: 2233-7857IJFGCN

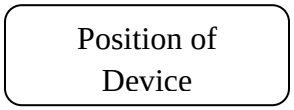


Figure5: Irrigation Control System block diagram

3.5.4 AI Controller:

This stage compares the required soil moisture with actual soil moisture and decision is made dynamically [12].

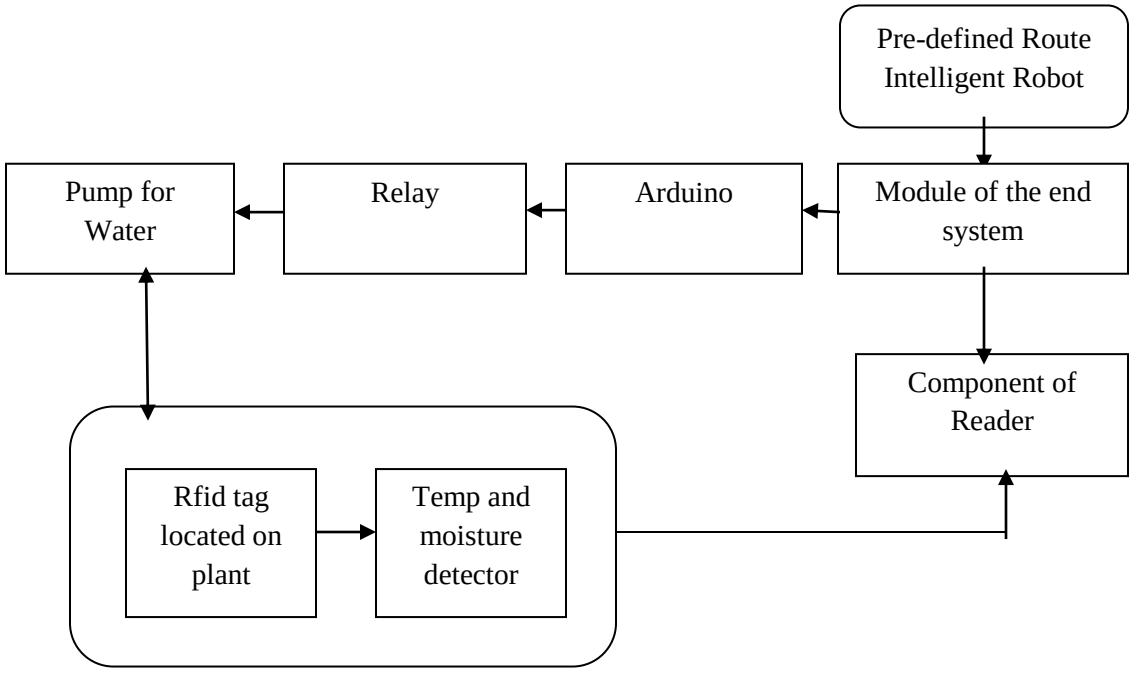
3.6 Architecture of plant watering robot:

Any region featuring plants set along of the preset path whereby the robotic follows can be the territory to be sprayed by the Automatic Robot Arm. As shown in figure 6

Due to the Ultrasonic sensor that reflects water and differ from color to color on account of the intensity of the light they receive, the track following more by plant must be blackness upon that green carpet. Every plant is marked with a Rfid system. RFID EM-18 is around 4 inches in size. The facility must have a robot arm around 4 inches. The RFID tag must face host device for RFID reading. The Bluetooth components utilized are preconfigured for network interactions [3].

As the water carriage capabilities are one liter because of gravity of the CD-motor, the machine can move only a quantity of water through one go. The quantity of containers and even the plants which have to be hydrated are therefore limited. The arrangement of the spark plug is as much as12V or less although a DC power is provided to the cooling system. The pressure regulator is powered by a 6V sensor that functions as a switch, and we make energy to turn on/off rather than contact it directly. An outside 9 volt equipment is necessary for a relay to activate.

The sensing component for weather conditions is positioned near the device to acquire the appropriate readings for a good system operation. The altitude of the rose bush is measured by the altitude of the moving robotics in order to provide watering conveniently to the flower by using garden hose [3].



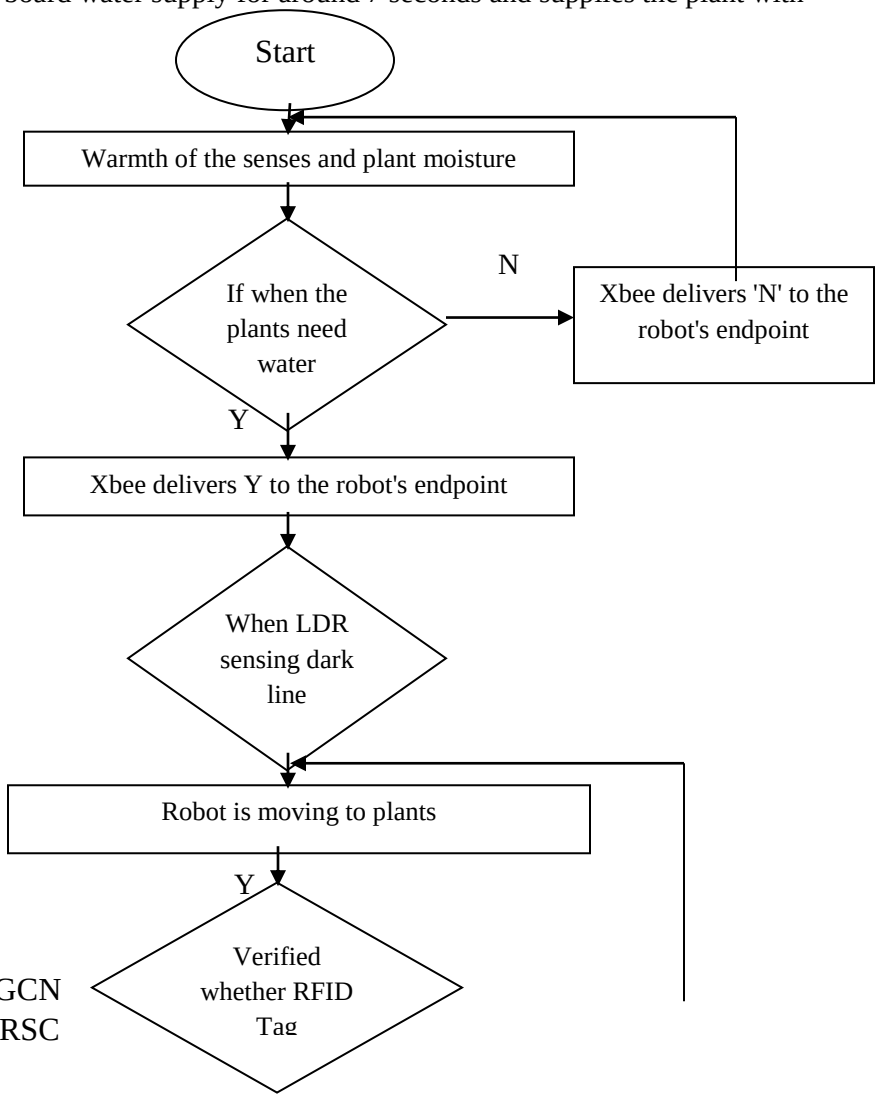
ISSN: 2233-7857IJFGCN

Figure 6: Architecture of Plant Watering Robot

4. Methodology

The module for the soil moisture sensor affixed to the vegetation measures the crop humidity levels. It decides if the vegetation wants oxygen or not by means of the associated controller, i.e. Arduino board. Use of the C code downloaded to the Arduino Uno board through the Arduino Microcontroller to measure water needs. The component of Module 1 offers an ongoing flow of data that reflects the status of the watering plant, while the mobile network on the robot is positive for the plant. When a robotic arm has to use the Xbee transmission mounted on the plant to the Xbee receptor on the traveling robotic Module 2, if somehow the plant produces watering based on the current configuration of its preset relative humidity criterion. When the system does not water is needed depending on the observed temperature and relative humidity readings and the configured criteria, the Xbee Supervisor transfers the 'N' toward the robot member nodes. The architecture of both the system shown in figure 7.

With the aid of LDR sensor located at the base including its automated driving, the machine picks up speed on the specified route when a 'Y' is received. The path is formed by a black square followed by the robotic until an RFID tag is detected. If the RFID reading module identifies an RFID tag, the robot will cease watering the observed vegetation for only about 10 seconds[16]. The connected relay is activated by providing it with a constant efficiency that switches off the linked catalytic converter when the tag is recognised. This pump gathers water first from creature's on-board water supply for around 7 seconds and supplies the plant with



ISSN: 2233-7857IJFGCN

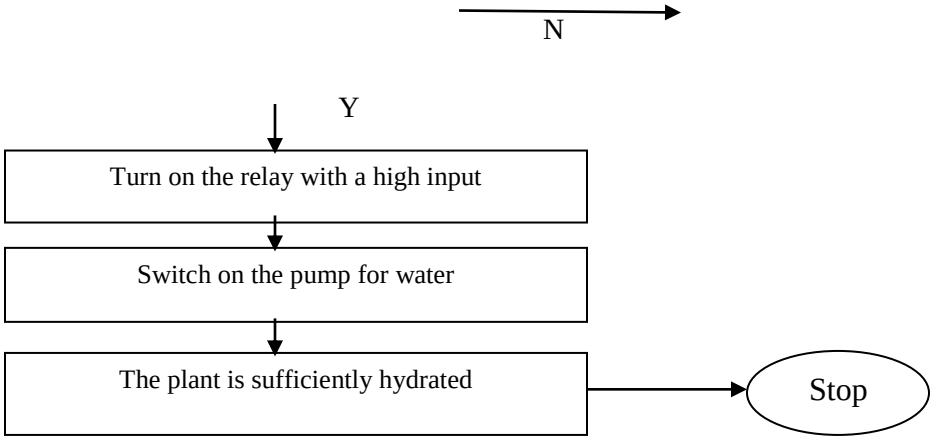


Figure 7: Control Flow Diagram of the System

freshwater. The independent truck waited for 3 seconds that after liquid has been fully discharged from the facility and afterwards moved on to further hydrate the other vegetation. So, this independent robotic arm hydroponic system washes every plant on its path. Because the seedlings are positioned inside a limited area in a squared fields, the temperatures of each plant shall be the same; so, just one sensing element shall be put and then all plants shall be hydrated as per the sensor readings. [4]

5. Result and Discussion

5.1 Performance and Evaluation:

That when an RFID tag is recognized, the watering of the palm tree requires a minimum of 10 seconds. It continued on the journey to the remainder of the flowers after quite a additional 3 seconds. In the case of a maximum of 55 plants with a total length of 20 centimeters, around 33.36 minutes were necessary. This will have 25,000 milliliters of water resource consumption.

Shown in table 1 and figure 8.

S.No	Time in minutes	Number of pots
1	15	23
2	25	33
3	35	44
4	45	55
5	55	66

Table 1: Analysis of time and water requirements according to the number of pots

ISSN: 2233-7857IJFGCN

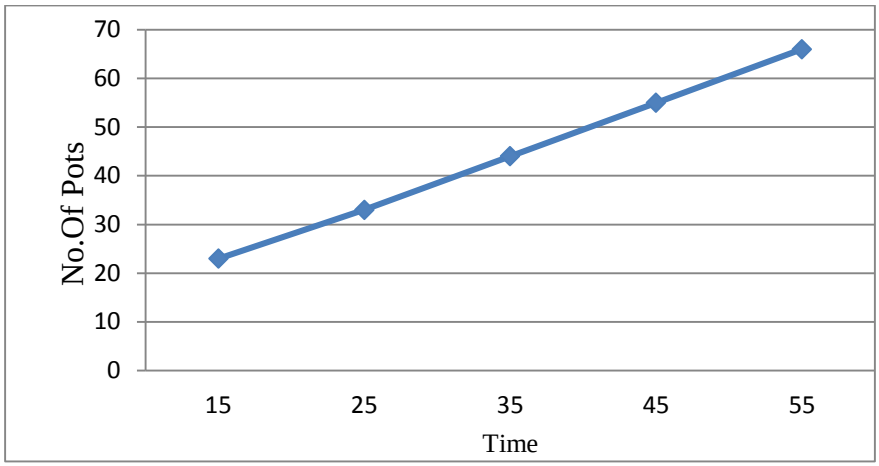


Figure 8: Analysis of time and water requirements according to the number of pots

5.2 Data on soil moisture at specified intervals of the day:

From figure 9, the amount of moisture at night is less than morning can be determined. When there was irrigation. High water content is shown by the blue curve. In the evening hours after robot was irrigated in the morning the Red Curve shows low moisture content. As mentioned in Table 2, dispersion required 7 days. It was completed distributed. Distributed.

Day	Forenoon	Afternoon
1	812	389
2	957	346
3	756	406
4	712	292
5	882	325
6	734	462
7	912	309

Table 2: Data on soil moisture at specified intervals of the day

ISSN: 2233-7857IJFGCN

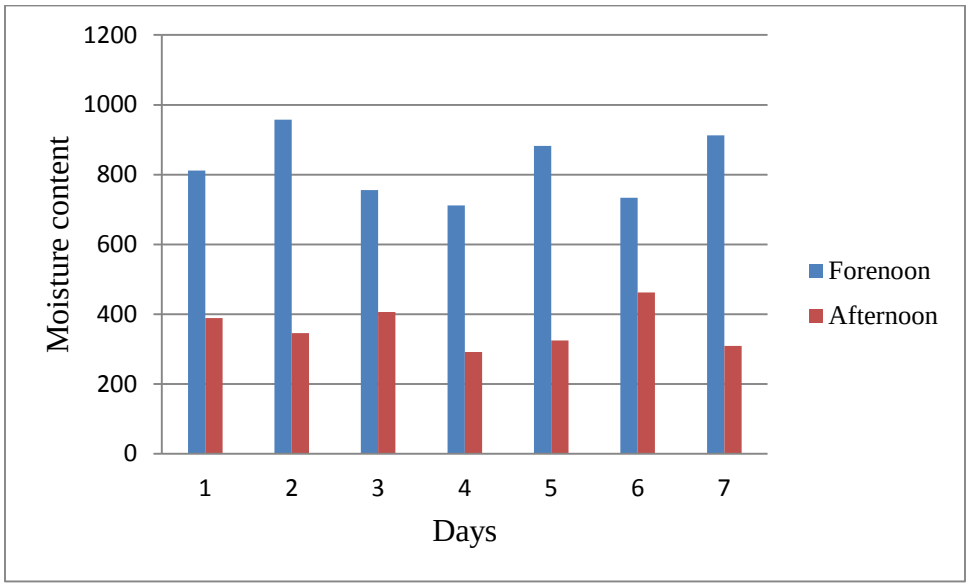


Figure 9: Data on soil moisture at specified intervals of the day

6. Conclusion

In this research, a truly automated method has been demonstrated to assist water indoors plants placed along a previously determined route. The plant irrigation robot has three major features for measuring, positioning and automatically fulfilling the irrigation needs of flowers with government interaction. The system includes a water engine, a relay, a sensor of moisture levels (HSM-20g), and a WLAN Xbee. Different investigations have tested the impact of the different components there in research. The computations are being shown for the numbers of containers, the time essential system to hydrate the specified set and also the water in milliliters. The technology function was measured by drawing a diagram that shows not only of the expense but also time-efficient number of irrigated installations and indeed the time necessary for the autonomous vehicle to conduct watering operations. This article outlines an easy way forward with the AI controller for irrigated regulation. These managers need not necessarily constitute system information and are able to adapt, contrary traditional method, to the environmental changes. AI-based methods may save a huge amount of resources (soil and water) and deliver optimum outcomes in all kinds of agricultural sectors. It is important to remember.

References

[1] P. Suriyachai, U. Roedig, and A. Scott, 2012.”A survey of MAC protocolsfor mission-critical applications in wireless sensor networks,” *Commun.Surveys Tuts.*, vol. 14, no. 2, pp. 240–264.

[2] Sehgal, S., et al.: Crop planning using stochastic visual optimization, 2017. IEEE Visual. Data Sci. VDS 2017, 47–51 (2018)

[3] Constantinos Marios Angelopoulos, Sotiris Nikoletseas, Georgios Constantinos Theofanopoulos, “A Smart System for Garden Watering using Wireless Sensor Networks”, *MobiWac '11 Proceedings of the 9th ACM international symposium on Mobility management and wireless access* Pages 167-170 ACM New York, NY, USA, 2011.

[4] Ayumi Kawakami, Koji Tsukada, Keisuke Kambara and Itiro Siio, “PotPet: Pet-like Flowerpot Robot”, Tangible and Embedded Interaction 2011, Pages 263-264 ACM New York, NY, USA, 2011.

ISSN: 2233-7857IJFGCN

[5] Y. Kim, R. Evans and W. Iversen, ―Remote Sensing and Control of an Irrigation System Using a Distributed Wireless Sensor Network‖, IEEE Transactions on Instrumentation and Measurement, Pages: 1379–1387, 2018.

[6] Wall R.W. and King B.A., "Incorporating plug and play technology into measurement and control systems for irrigation management", *presented at the ASAE/CSAE Annu. Int. Meeting*, Ottawa, ON, Canada.

[7] Kumar, G., 2014. Research paper on water irrigation by using wireless sensor network. International Journal of Scientific Engineering and Technology, IEERT conference Paper, 123-125.

[8] Mrs.T.Vineela, J. NagaHarini, Ch.Kiranmai, G.Harshitha, B.AdiLakshmi, "IoT Based Agriculture Monitoring and Smart Irrigation System Using Raspberry Pi,"International Research Journal of Engineering and Technology (IRJET)e-ISSN: 2395-0056 Vol. 05 Issue: 01, 2018 .

[9] Varatharajalu, K., Ramprabu, J., 2018.Wireless Irrigation System via Phone Call & SMS. International Journal of Engineering and Advanced Technology. 8 (2S), 397–401.

[10] Bernard Cardenas-Lailhacar, Michael D. Dukes, Grady L. Miller, Sensor-Based Control of Irrigation in Bermudagrass.An ASAE Meeting Presentation Paper Number: 052180.

[11] Karandeep K, "Machine Learning : Applications in Indian Agriculture", International Journal of Advanced Research in Computer and Communication Engineering, Vol.5, no.4, pp.342-344, 2016.

[12] Prakash Persada, Nadine Sangsterb, Edward Cumberbatchc, AneilRamkhalawand andAatmaMaharajh, "Investigating the Feasibility of Solar Powered Irrigation for Food Crop Production: A Caroni Case," ISSN 1000 7924 The Journal of the Association of Professional Engineers of Trinidad and Tobago, Vol.40, No.2, pp.61-65, October/November 2011.

[13] Manual by Martin Hebel and George Bricker , " Getting Started with XBee RF Modules: A Tutorial for BASIC Stamp and Propeller Microcontrollers", Version 1.0, ISBN 9781928982562.

[14] Navarro-hellín, H., et al.: A decision support system for managing irrigation in agriculture. Comput. Electron. Agric. 124, 121–131 (2016)

[15]. Pravin Kshirsagar and Sudhir Akojwar, "Hybrid Heuristic Optimization for Benchmark Datasets", International Journal of Computer Application (0975-8887),Vol.146- No.7,July 2016 .

[16]. Pravin Kshirsagar and Dr. Sudhir Akojwar, "Novel Approach for Classification and Prediction of Non Linear Chaotic Databases", International Conference on Electrical, Electronics, and Optimization Techniques, March 2016.

[17]. Pravin Kshirsagar and Dr. Sudhir Akojwar, "Prediction of Neurological Disorders using Optimized Neural Network", proceeding of International Conference on signal processing, Communication, Power and Embedded System ,October (2016).

[18]. Sudhir Akojwar, Pravin Kshirsagar, "A Novel Probabilistic-PSO Based Learning Algorithm for Optimization of Neural Networks for Benchmark Problems", WSEAS International conference on Neural Network-2016, Rome, Italy.

[19]. Sudhir Akojwar, Pravin Kshirsagar, "Performance Evolution of Optimization Techniques for Mathematical Benchmark Functions", WSEAS International conference on Neural Network2016, Rome,Italy.

[20]. Pravin Kshirsagar, Dr. Sudhir Akojwar, "Classification & Detection of Neurological Disorders using ICA & AR as Feature Extractor", International Journal Series in Engineering Science (IJSES), Volume 1, Issue 1, 2015.

ISSN: 2233-7857IJFGCN

[21]. Pravin Kshirsagar, Dr. Sudhir Akojwar, "Classification and Prediction of Epilepsy using FFBPNN with PSO", IEEE International Conference on Communication Networks, 2015.

[22]. Kshirsagar PR, Akojwar SG, R. Dhanoriya, "Classification of ECG-signals using Artificial NeuralNetworks",https://www.researchgate.net/publication/317102153_Classification_of_ECGsignals_using_Ar tificial_Neural_Networks, International Conference on Electrical, Computer and Communication Technologies. 2017 .

[23]. Dr. Sudhir Akojwar, Pravin Kshirsagar, Vijetalaxmi Pai "Feature Extraction of EEG Signals using Wavelet and Principal Component analysis", National Conference on Research Trends In Electronics, Computer Science & Information Technology and Doctoral Research Meet, Feb 21st & 22nd ,2014

[24] Pravin Kshirsagar, Nagaraj Balakrishnan & Arpit Deepak Yadav (2020) Modelling of optimised neural network for classification and prediction of benchmark datasets, Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization, 8:4, 426- 435, DOI: 10.1080/21681163.2019.1711457

ISSN: 2233-7857IJFGCN