iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH
IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 Issue: VI Month of publication: June 2022

DOI: https://doi.org/10.22214/ijraset.2022.44382

Smart Agriculture Monitoring & Auto Irrigation System using IoT with ESP8266

Ankit Mishra[1], Anurima Majumdar[2], Adrita Roy[3], Antara Ghosal[4], Palasri Dhar[5], Suparna Biswas[6], Sunipa Roy[7]
[1, 2, 3, 4, 5, 6, 7]*Department of Electronics & Communication Engineering, Guru Nanak Institute of Technology, Kolkata-700114*

Abstract: In this paper, an IoT-based smart agriculture monitoring and automatic irrigation system are proposed by using ESP8266 Node MCU. Multiple sensors like capacitive soil moisture sensors are fixed inside to measure moisture content present in the soil which will help in the auto-detection of water requisition in the soil. DS18B20 waterproof temperature sensor will measure the temperature of the soil. The DHT22 is used as a humidity and temperature sensor to measure the air temperature and humidity. Soil relative humidity, air temperature, soil temperature, and relative humidity of air are also measured. A small OLED Display is used which is 0.96 inches in size. If any unwanted intrusion by animals or humans is detected on the farm, a PIR motion sensor is used to detect their motion activity. A rain detector sensor is used to detect rain status. A 5 Volt buzzer is for the Alert system and a 5-volt power relay is to control the water pump, whenever a low quantity of moisture is detected in the soil. Overall by using these farming systems users get more benefits and good results from their farming.
Keywords: Smart Agriculture using IOT, Internet of Things (IOT), Arduino, Water level Sensor, Soil Moisture Sensor, Rain Sensor, etc.

I. INTRODUCTION

The application of IoT is emerging in the field of agriculture. Researchers have been working on different smart technologies to develop an efficient agriculture system including irrigation, harvesting, maintenance, monitoring, etc. The authors [1] discussed the scenario of a smart agriculture system using IoT to make farming easy and by using this smart system of agriculture the farmers are always getting updated on their crops and all farming systems. Author's reported a system [2] To cope with the use of temperature and moisture sensors at suitable locations for monitoring of crops is implemented in. In [3] the author developed an algorithm developed with threshold values of temperature and soil moisture that can be programmed into a microcontroller-based gateway to control water quantity. The power can be supplied to the system by photo-voltaic panels and can have a binary communication link based on a cellular Internet intersection for programming the inspection of data and irrigation scheduling through a web page. In [4] the authors have reported the technological development in open source software and hardware, which makes it easy to develop the device. Also, it can make better monitoring and wireless sensor networks, which will be used for monitoring and controlling greenhouse parameters in precision agriculture.[5] The changing dynamics, and non-linearity of soil moisture content, as well as other weather and plant variables, require real-time monitoring and an accurate predictive model for effective irrigation and crop management. In this paper, an improved monitoring and data-driven modeling of the dynamics of parameters affecting the irrigation of the mustard leaf plants are presented.[6] Additionally, it provides a large number of work opportunities for inhabitants. Due to lack of facilities many farmers till now do traditional farming, which result in low yields. Agriculture and related industries plays a vital role in increasing the economy's long-term growth and development. [7] One of the most important factors for successful agricultural production is the irrigation system in place. In this study, a precision irrigation system, which takes advantage of the various phases of plant growth, was developed and implemented using the sensor network technology integrated with IOS/Android. The amount of water in the soil was measured via sensors that were placed on certain points of the area to be irrigated. [8] The advent and rapid successes of the Internet of Things (IoT) and advanced control strategies are being leveraged to achieve improved monitoring and control of irrigation farming. [9] Advances in electronics, computation, and the internet of things are integrated for improving field inputs management. [10] The authors presented and implemented the design of an intelligent IoT-multiagent precision irrigation approach for improving water use efficiency in irrigation systems. The motor get switched ON automatically and the irrigation is done. When the soil becomes completely wet the motor get switched OFF automatically. These all things can be controlled remotely using the ESP8266 NodeMCU board and Blynk app Platform even from other countries also.

In this paper, a Node MCU ESP8266 board, a capacitive soil moisture sensor, DS18B20 waterproof temperature sensor, DHT22 Temperature, and Humidity sensor, PIR Motion sensor, Rain detector sensor, 0.96-inch OLED display, 5 Volt single channel relay module, a buzzer, and a 5-volt dc pump motor.

The motor is used for drawing water from the inlet and throwing water through the outlet. A pipe can be connected to it. Hence, we will add such new features as reading all the sensors in the mobile app, will manage the configuration of every sensor by mobile app, and watching every moment of the plot by CCTV camera.

A. Equipment Required

1) *Esp 8266 Node MCU:* The name "NodeMCU" combines "node" and "MCU" (micro-controller unit).The term "NodeMCU" strictly speaking refers to the firmware rather than the associated development kit. The firmware is based on the eLua project and built on the Espressif Non-OS SDK for ESP8266. It uses many open source projects, such as lua-cjson and SPIFFS.

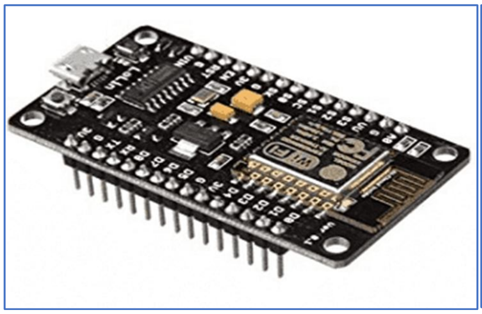


Fig 1: Esp-8266 micro-controller

Fig 2: Moisture sensor

2) *Moisture Sensor:* Moisture sensor is to measure moisture content present in the soil.
3) *DS18B20 Waterproof Temperature Sensor:* This waterproof temperature sensor is used to measure the temperature of the soil.

Fig 3: Waterproof temperature sensor

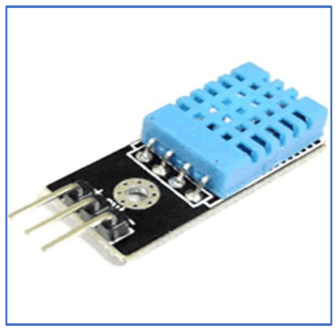


Fig 4: DHT22 Humidity & temperature Sensor

Fig 5: PIR Sensor

4) *DHT22 Humidity Temperature sensor:* Used to measure the air temperature and humidity.
5) *PIR Sensor:* A PIR motion sensor is used to detect motion activity.
6) *Rain Sensor:* A rain sensor or rain switch is a switching device activated by rainfall. There are two main applications for rain sensors. The first is a water conservation device connected to an automatic irrigation system that causes the system to shut down in the event of rainfall. The second is a device used to protect the interior of an automobile from rain and to support the automatic mode of windscreen wipers.

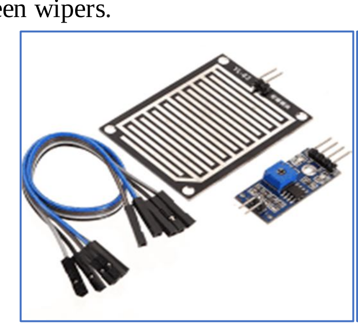


Fig 6: Rain Detector sensor

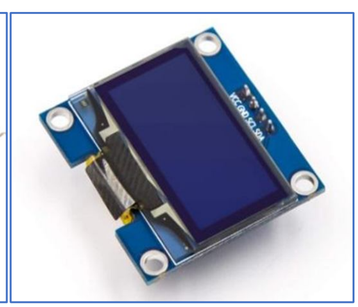


Fig 7: O-Led Screen

ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue VI June 2022- Available at www.ijraset.com

Fig 8: Buzzer For Alarm and emergency alert

7) *OLED Display (0.96-inch):* OLED is an Organic Light Emitting Diode. OLEDs are made when a series of organic thin films are placed between two conductors. This can be considered the world's best organic display. A bright light is emitted when an electric current is applied to it.
8) *5-volt Single Channel Relay Module:* Relay is an electronic mechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is comprises of components which make switching and connection easier. It acts as indicators to show if the module is powered and activeness of the relay.
9) *Buzzer:* A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.
10) *5volt Water Pump:* DC motors are rotary electrical machines that convert electrical energy into mechanical energy (Rotation).

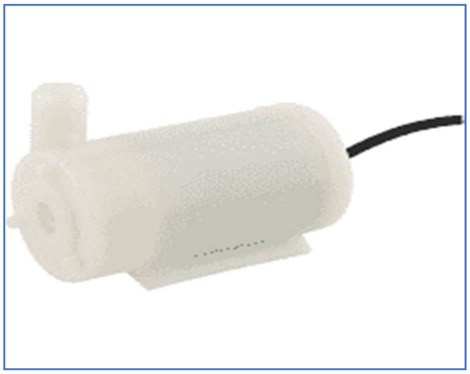


Fig 9: Water Pump

B. *Circuit Diagram and Analysis*

In figure 10 the circuit diagram and the connectivity is shown. To connect the soil moisture sensor to the A0 pin of Node MCU and DHT22 to the D4 Pin. DS18B20 temperature sensor to D6 pin. PIR Motion Sensor to D3 pin.

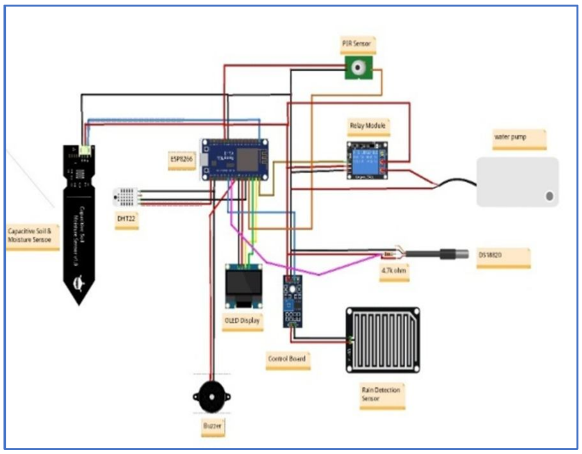


Fig 10: The schematic of this project. I used fritzing software to design this circuit diagram.

Buzzer to Rain Sensor and D5 pin to D7 Pin of Node MCU. To control the relay the motor is connected to Relay, In Node MCU we use the D0 Pin. The I2C pin (D1 & D2 pin) of Node MCU we've to connect the OLED display. Using the5V PIN you can power the PIR sensor, DS18B20 sensor, Water Motor, relay and Buzzer. In 3.3V supply, the capacitive soil Moisture Sensor, DHT22 Sensor and OLED Display are required.

C. Literature Survey

The application of IoT is emerging in the field of agriculture. Researchers have been working on different smart technologies to develop an efficient agriculture system including irrigation, harvesting, maintenance, monitoring, etc. The authors [1] discussed the scenario of a smart agriculture system using IoT to make farming easy and by using this smart system of agriculture the farmers are always getting updated on their crops and all farming systems. Author's reported a system [2] To cope with the use of temperature and moisture sensors at suitable locations for monitoring of crops is implemented in. In [3] the author developed an algorithm developed with threshold values of temperature and soil moisture that can be programmed into a microcontroller-based gateway to control water quantity. The system can be powered by photo-voltaic panels and can have a duplex communication link based on a cellular internet interface that allows data inspection and irrigation scheduling to be programmed through a web page.

In [4] the authors have reported the technological development in open source software and hardware, which makes it easy to develop the device. Also, it can make better monitoring and wireless sensor networks, which will be used for monitoring and controlling greenhouse parameters in precision agriculture.[5] The changing dynamics, and non-linearity of soil moisture content, as well as other weather and plant variables, require real-time monitoring and an accurate predictive model for effective irrigation and crop management. In this paper, an improved monitoring and data-driven modeling of the dynamics of parameters affecting the irrigation of the mustard leaf plant is presented. [6] Additionally, it provides a large number of work opportunities for inhabitants. There are many farmers who prefer traditional farming approaches, which result is in low yields. Now a days Agriculture and related industries are important to development and the economy's long-term growth. [7] One of the most important factors for successful agricultural production is the irrigation system in place. In this study, a precision irrigation system, which takes advantage of the various phases of plant growth, was developed and implemented using the sensor network technology integrated with IOS/Android. The amount of water in the soil was measured via sensors that were placed on certain points of the area to be irrigated. [8] The advent and rapid successes of the Internet of Things (IoT) and advanced control strategies are being leveraged to achieve improved monitoring and control of irrigation farming. [9] Advances in electronics, computation, and the internet of things are integrated for improving field inputs management. [10] This paper aims to present the design and implementation of an intelligent IoT- multiagent precision irrigation approach for improving water use efficiency in irrigation systems.

II. SETTING UP THE MOBILE APP (BLYNK)

For this project download the Blynk app from the App store or from Play store. Create your account by giving your credential. Then, select an open button and create a new project. Mention the name of your project as I am taking "Agro Tech". After that Select the board as NodeMcu, then the connection type is Wi-Fi, and then click on create now button. The verification link will be sent to your registered email address. Now come on to the programming part. First of all, we will add a gauge. So select the gauge, click on it and name it as soil sensor. Now select the input pin as virtual pin V1 and Change the label to "%". You can change the color of your gauge and also change the refresh rate to 1 second. Similarly, add a gauge for soil temperature configured to V2 Pin. Air Temperature Gauge configured to V3 pin. and Air Humidity Configured to V4 Pin respectively. Now we'll add a button, then we'll open this button and we'll select virtual pin V0 for it. and it will be for the PIR motion sensor. we'll select the mode to switch. Here we will add LED for Pump status. The LED is configured to Virtual Pin V5. Finally, select the notification widget. It receives notifications sent from nodemcu for the alert system. So, this is our newly configured Blynk IoT Dashboard for Monitoring sensor data online.

III. DEMONSTRATION: IOT BASED SMART AGRICULTURE & AUTOMATIC IRRIGATION SYSTEM WITH NODEMCU

The OLED Screen displays the Relative Humidity of Soil, Temperature of the soil and Air with Relative Humidity of air. Similarly, we can also see the relative humidity in the Air. There is one ON/OFF button for the PIR motion sensor. Therefore, for the water pump, we have LED status. At first, we will test the soil moisture sensor. Imagine here we are taking this little lucky bamboo plant to test this soil moisture sensor. After that will dip the sensor inside the water, and then we can see the reading Increasing. When we remove this sensor from here we can see that the percentage is decreasing.

Another feature i.e. when the soil moisture decreases, alarms get activated and the water pump is turned automatically. We can also see the pump LED glowing on the Farm app.

We have also received a message to water my plants because the sensor was dry, and it was not in the water.

Now let’s test this rain sensor. Just pour some water into the sensor, As we can see user got a message that, it’s raining.

Here is a PIR motion sensor. Always the sensor need to be turned on for detection. After activation when a user does any kind of movement in front of the sensor, will detect the motion, and will be sent a message to the user's smartphone.

IV. CONCLUSION

This project is all about a smart irrigation system that gives all the latest and a recent update to users by the Blynk app. The number of challenges and limitations considers the most IoT-based devices for smart agriculture. The main focus is cost-effectiveness in the IoT devices in the reduction of hardware and software costs with compromising precision system output. the proposed integrated system will provide complexity due to many devices interlinked through a web server. Finally, the deep learning analysis with a huge number of features or data can increase the production of smart agriculture by IoT.

REFERENCES

[1] Nikesh Gondchawar , Prof. Dr. R. S. Kawitkar, ”The newer scenario of decreasing water tables, drying up of rivers and tanks, and unpredictable environment present an urgent need for proper utilization of water” International Journal of Advanced Research in Computer and Communication Engineering ,Vol. 5, Issue 6, June 2016

[2] Sumaya Sanober, Noorul hasan Naveed Quadri,”Implementing Machine Learning for Smart Farming to Forecast Farmers’ Interest in Hiring Equipment” Journal of Sensors, Research Article , Open Access Volume 2022, Article ID 4721547,

[3] Xuan Chu, and Han Fu,”Edge Computing-Enabled Wireless Sensor Networks for Multiple Data Collection Tasks in Smart Agriculture”, College of Mechanical and Electrical Engineering, Zhongkai University of Agriculture and Engineering, Guangzhou 510225,Journal of Sensors, Volume 2020 Article ID 4398061|

[4] Sung-An Lee and Byung-Geun Lee,“Accurate 3D Surface Reconstruction for Smart Farming Application with an Inexpensive Shape from Focus System”Journal of Sensors, Research Article Open Access Volume 2020,Article ID 1859512 https://doi.org/10.1155/2020/1859512

[5] Khongdet Phasinam, Thanwamas Kassanuk and Mohammad Shabaz “Applicability of Internet of Things in Smart Farming” Journal of Sensors, Volume 2022 Article ID 7692922 https://doi.org/10.1155/2022/7692922

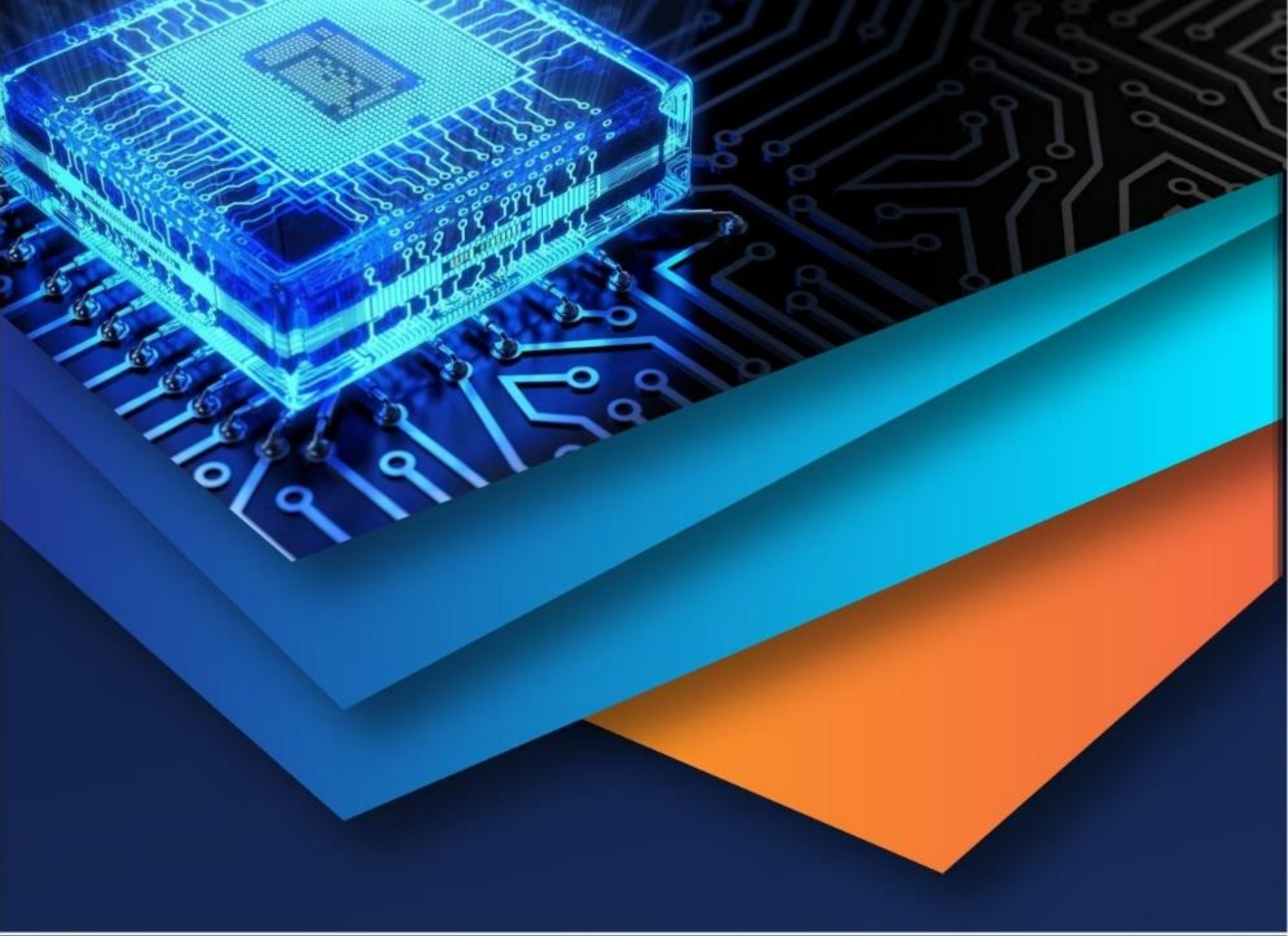
[6] Thanwamas Kassanuk, and Mohammad Shabaz, “Applicability of Internet of Things in Smart Farming”,Arba Minch University, Arba Minch, Ethiopia, India,Journal of Sensors,Volume 2022 Article ID 7692922 https://doi.org/10.1155/2022/7692922

[7] Emmanuel Abiodun Abioyeab Mohammad Shukri Zainal Abidina Mohd Saiful Azimi Mahmuda Salinda Buyamina, “The changing dynamics, non-linearity of soil moisture content, as well as other weather and plant variables requires real-time monitoring and accurate predictive model for effective irrigation and crop management” Journal of Sensors, Volume 8, Issue l2, June 2021https://doi.org/10.1016/j.inpa.2020.05.004

[8] L. Oborkhale, A. Abioye, B. Egonwa, T. Olalekan,”Design and implementation of automatic irrigation control system”IOSR J of Comput Eng, 17 (4) (2015), pp. 99-11

[9] Muhammad Khairie Idham Abd Rahman , Abdul rahaman Okino Otuoze, PatrickOnotu, Muhammad Shahrul Azwan Ramli,”A review on monitoring and advanced control strategies for precision irrigation” Computers and Electronics in Agriculture Volume 173, June 2020, 105441

[10] Andres-F Jimenez, Fabian Jimenez,“Intelligent IoT- multiagent precision irrigation approach for improving water use efficiency in irrigation systems at farm and district scales”, Computers and Electronics in Agriculture. Volume 192, January 2022, Article - 106635



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY