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# AUTOMATION IN GARDEN PLANT WATERING

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***Abstract-*** **The manual interference in workplace; from field to customer service all are getting replaced by automation technology. The collection of data, recognition of errors, response to commands and precise execution of tasks with the use of automation technology have proven to be one of the best solutions to reduce the stress on physical labour. The raising number of internet users has made everything smart and intelligent including the farm work. The use of the revolutionary technology IoT has made the task easier. In the field of agriculture, it assists farmers to provide live data for environment monitoring which helps them to increase quality and quantity of products. This project aims in improvisation of the garden plant watering system round the clock. The project uses NodeMCU ESP8266, DHT11Humidity and Temperature Sensor, Soil Moisture Sensor, PIR Motion Sensor, Breadboard, Jumper wires and live data feed can be monitored on serial monitor and Blynk mobile app.**

***Keywords-*** *Automation Technology, IoT, Humidity and Temperature Sensor, Soil Moisture Sensor*

## 1. INTRODUCTION

All unit operations in agriculture and crop production involves drudgery. Adaptation of automation has made the way of living easier for farmers and farm workers. Agricultural automation is a variety of tech innovations in traditional practices to optimize the food production process as well as to improve quality of the products. Taking care of consumer preferences, shortage of labor and ecological responsibility automation proved to be major solution of a number of challenges. The robots and autonomous machines such as automated tractors, seeding and weeding robotics, automatic irrigation devices, harvest automation; and drones in monitoring and analysis, planting, irrigation etc. are ways to use automation technology in agriculture. The Internet of Things provides internet-enabled devices that transform the agricultural automation. Automation in irrigation reduces the manual intervention while using devices to operate irrigation system. It eliminates the manual labor for opening and closing of valves. It starts and stops pump exactly as and when required thus optimizing the energy requirement.

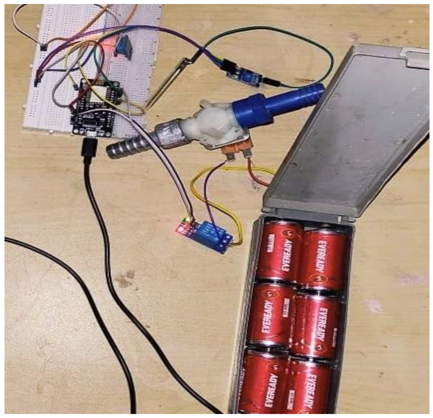
The project is inspired by smart gardening and home appliances based on IoT that completes the field work more precisely and efficiently. The objective is to automate the watering of plants and providing user friendly system and require low-tech knowledge, estimate water supply, eliminate waste of water, take measurement of soil temperature and moisture levels. Even elderly people can feel at ease while using this and can avoid physical work. If family is moving out for long duration, they can get daily updates about their garden and instruct the gadgets to follow the instructions as per the requirement of plants.

## 2. MATERIALS AND METHODS

A few IoT gadgets have been used to focus on live monitoring of environmental data in terms of temperature, moisture, relative humidity by putting the system in the field and getting feeds on various devices like smart phone and the data generated via sensors being easily shared and viewed by user anywhere remotely. The system also enables analysis of various sorts of data via Big Data Analytics from time to time.

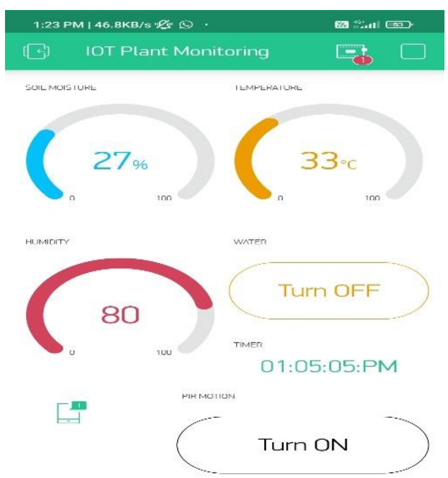
NodeMCU is a development board that is used for IoT applications. The sensors; the soil moisture sensor, the temperature and humidity sensor and PIR motion sensor have been used for collecting field data and the relay module played the role of actuator.

The soil moisture sensor helps in managing the water requirement of plant and in understanding the root zone condition. With the proper management of water application to plants and herbs, it provides growth and longevity. The soil moisture sensor is fixed inside the soil in the field and help in maintaining water level by constant information getting via sensor. The water flow is allowed as per requirement, as relay switch operates the pump. Initially the percentages of moisture are taken and decisions are made accordingly. The temperature and humidity sensor (DTH11) is fixed on the field to get the overall reading of temperature and relative humidity of the environment. The PIR Motion Sensor is fixed to detect any intruder into the boundary. This low-cost sensor senses presence of moving body by the change in surrounding. The presence of IR energy helps device to work in night also. These sensors are connected to NodeMCU. All sensors use to send data to NodeMCU and data again gets delivered to user. The threshold value is marked based on the requirement of the plant specified and predefined for every sensor. Whenever any sensor reaches a threshold value, message alert is sent to the user and action is taken according to it.



(Fig No. 2.1 Integration of sensors with actuators)

After programming the NodeMCU Wi-Fi credentials has to be updated from the Blynk App. The Blynk controls the gadgets with Wi-Fi and monitor real time status of the relays from anywhere with the Blynk IoT App.




(Fig No. 2.2 Field information through Blynk App)

MODE OF OPERATON

The automated system is powered by a 9 V battery which supplies DC power to the water pumping machine. The water pump is activated by the relay module, which gets powered by the 9V DC power supply. Additionally, the moisture sensor module is placed in the field close to the plants. The soil moisture sensor helps to transmit continuous stream of soil moisture data to the system, through the sensor node on the basis of which the robot acts accordingly.

## 3. RESULT AND DISCUSSION

The observations have been recorded for on 5 different plants for 7 days from March (2022) end to end of April 2022, to measure the average water requirement by the plant with a little fluctuation in moisture percentage. The average water requirement per day for each plant has been studied. The cross-sectional area of pipe is 0.0376 $m^2$ and discharge is 0.9 lit/sec.

**Papaya *(Carica papaya):***

(Table 3.1 Water requirement of Papaya)

| Days | Soil moisture percentage (initial) | Soil moisture percentage (final) | Time taken for water application (sec) | Total water required (lit/day) |
|---|---|---|---|---|
| 01 | 22 | 87 | 31.8 | 28.7 |
| 02 | 23 | 85 | 32.2 | 29 |
| 03 | 25 | 88 | 35 | 31.5 |
| 04 | 25 | 88 | 32.2 | 29 |
| 05 | 26 | 89 | 37.4 | 33.7 |
| 06 | 23 | 85 | 34.4 | 31 |
| 07 | 24 | 85 | 30 | 27 |

A grown-up papaya plant requires 25-35 lit on an average (in bearing stage). Being in early stage, irrigation have been given in 2 days interval, as it requires well drained field condition.

**Mango *(Mangifera indica):***

(Table 3.2 Water requirement of Mango)

| Days | Soil moisture percentage (initial) | Soil moisture percentage (final) | Time taken for water application (sec) | Total water required (lit/day) |
|---|---|---|---|---|
| 01 | 45 | 90 | 131.5 | 118.39 |
| 02 | 43 | 87 | 129.6 | 116.7 |
| 03 | 43 | 88 | 130 | 117.01 |
| 04 | 46 | 90 | 131.1 | 118 |
| 05 | 45 | 89 | 129.7 | 116.76 |
| 06 | 46 | 90 | 131.8 | 118.67 |
| 07 | 44 | 90 | 131.1 | 118 |

A full-grown mango tree requires about 120 lit/day. So, we watered it every day and took the reading of consecutive days.

**Chilli *(Capsicum frutescens):***

(Table 3.3 Water requirement of Chilli)

| Days | Soil moisture percentage (initial) | Soil moisture percentage (final) | Time taken for water application (sec) | Total water required (lit/day) |
|---|---|---|---|---|
| 01 | 45 | 87 | 0.55 | 0.5 |
| 02 | 50 | 90 | 0.51 | 0.46 |
| 03 | 51 | 93 | 0.33 | 0.3 |
| 04 | 56 | 95 | 0.42 | 0.38 |
| 05 | 57 | 90 | 0.55 | 0.5 |
| 06 | 60 | 88 | 0.52 | 0.47 |
| 07 | 55 | 89 | 0.55 | 0.5 |

The plants need less amount of water (around 0.5 lit/day). It is better to water it when the upper soil seems to be dry. For which the readings in 2 days interval because the plant is potted so the water evaporation and drainage is lower.

**Hibiscus*:***

(Table 3.4 Water requirement of Hibiscus)

| Days | Soil moisture percentage (initial) | Soil moisture percentage (final) | Time taken for water application (sec) | Total water required (lit/day) |
|---|---|---|---|---|
| 01 | 52 | 87 | 1.27 | 1.143 |
| 02 | 54 | 86 | 1.272 | 1.145 |
| 03 | 53 | 87 | 1.27 | 1.143 |
| 04 | 53 | 89 | 1.27 | 1.143 |
| 05 | 54 | 89 | 1.271 | 1.144 |
| 06 | 53 | 87 | 1.26 | 1.139 |
| 07 | 52 | 87 | 1.27 | 1.143 |

This plant needs saturated soil to grow means frequent watering is necessary in summer. But it can be avoided to 2 days or more if it is rainy.

**Sada bahar *(Catharanthus roseus*)*:***

(Table 3.5 Water requirement of Sadabahar)

| Days | Soil moisture percentage (initial) | Soil moisture percentage (final) | Time taken for water application (sec) | Total water required (lit/day) |
|---|---|---|---|---|
| 01 | 65 | 89 | 0.14 | 0.13 |
| 02 | 75 | 90 | 0.12 | 0.11 |
| 03 | 77 | 88 | 0.25 | 0.23 |
| 04 | 76 | 89 | 0.16 | 0.15 |
| 05 | 78 | 90 | 0.13 | 0.12 |
| 06 | 76 | 90 | 0.14 | 0.13 |
| 07 | 68 | 88 | 0.18 | 0.17 |

This sun loving plant needs wet soil but overwatering causes yellowing of leaves. The plant needs to be watered every day.

## 4. CONCLUSION

To maintain healthy eating habits, the practice of agricultural production is becoming more challenging to ensure both demand and quality. Enabling modern methodologies have significant improvement on production but still quality being the concern. The use of IoT has incredible result in controlling unwanted damage to monitoring the plant requirement. Involvement of various applications not only ensures lowering in the waste of money and labor but also improvised practice methods for profit. The project aims at providing an easy-to-use model to irrigate and monitor the plants for the people having less knowledge in maintaining gardening or physically challenged people who undertake the garden work. It is proved to be convenient to use including the use of external power source. There is no ambiguity in accessing data from plant or commanding to act. Our observation over different plants to check the workability and efficiency of the sensors while responding to command for irrigation. Thus, proves successful.

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