IOT-BASED SMART GARDENING SYSTEM USING ARDUINO UNO

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***Abstract*—Environmental awareness is one of the most important factors for environmental sustainability. This paper describes a Smart gardening system using an IoT platform.**

The main purpose of this automation is to make home gardening more convenient by eliminating manual work. The Soil Moisture Sensor has many applications in agricultural research, everyday gardening, and humidity and temperature sensors. By tracking the amount of water in your soil, you can ensure your valuable crops stay hydrated and know how they're doing before planting.

Our project uses a soil moisture meter and a humidity and temperature sensor using the ESP8266 to alert the user when plants need to be watered. Next, we built an automatic irrigation system using the IoT board. Our system also includes an OLED display and uses an IoT cloud, so you can monitor and control the system over the internet.

PIR sensors are built into the system to help prevent pests from getting closer to your plants or destroy plants. Additionally, after much research, our project includes a purple LED light to stimulate plant growth.

***Index Terms*—IoT, ESP8266 micro controller, soil moisture sensor, humidity sensor and temperature sensor, PIR sensor, purple LED lights**

I. INTRODUCTION

The rooftop garden is a garden, either vegetable or decorative on the terrace of a building. Rooftop gardens also called living roofs or green roofs, have many benefits. The majority of the rooftop gardens also provide recreational opportunities for family members. On hot summer days, rooftop gardens may also keep buildings cooler than traditional roofs. Rooftop farming can provide a solution to increased food demand and also can promote a sustainable and livable city. Rooftop farming can benefit society by improving air quality, and reducing carbon in the atmosphere, thereby creating a healthy environment. Moreover, people will get pesticide-free vegetables with their own effort. Rooftop gardens are both beautiful and occasionally challenging. Here are the common problems a gardener may have with a rooftop garden

- Accessibility to water and drainage issues
- A way to bring gardening supplies to the
- roof Storage
- More extreme weather exposure to your plants

In addition to this, in houses or places where there is no adequate

The main objectives of our project is to provide water according to the moisture content of the soil and to prevent the pests attack such as squirrel and rat.

II. PROBLEM STATEMENT:

To provide an efficient home gardening support system using a wireless sensor network which handles different activities of our rooftop or kitchen gardens and gives useful information related to the same. Information related to Soil moisture, Temperature, pest detection, and light required for photosynthesis is provided. Due to extreme weather conditions faced these days, the Water level is managed by the smart system in both automatically/Manual using our mobile application. It will make gardening more comfortable for busy home gardeners since gardening can be time-consuming.

III. LITERATURE SURVEY

Automatic Watering System using Soil Moisture Sensor and RTC timer with Arduino

[Dr. Geetha S , Dr. Y. Asnath Phamila , P Vaishnavi , Y Lakshmi Sai Charitha , T Jayasri , Manchikanti Bhumika , Nelakurthi Sudheer Kumar February 2022]

This research paper deals with the management of water application, the main purpose is also to save our time, save plants from drying out and extend their lifespan. It uses a moisture sensor to measure the water content of the soil in the plant, a water pump for artificial pumping, a relay as an electrically controlled switch, and a timer module. Depending on the soil moisture, the water pump is switched on or off. This research is done using Arduino on Arduino ide. This helps to water the plant even in your absence for a long period like 10-15 days, we have also worked on a timer-based automatic watering system.

Automatic plant irrigation system

[S.Thilagavathi, Aishwarya Rajendran, K.Priyadharshini December 2016]

This proposed model consists of three stages: Firstly, sensing the land's moisture levels. The second stage is the determination of its status: dry or wet. The last and third stage is Motor control. This project starts with the checking of the moisture level of the soil, if yes, then it will start the irrigation, after that it will send a signal to the relay circuit which is connected to the motor and then it will start the solenoid and the motor which starts to water the plant. If the status is no, then it won't do any of the above works. This system has some limitations it needs a large amount of sensing equipment for very large irrigation areas and the system is not 100% reliable there might be some errors and cause loss.

Real-Time Crop Monitoring Using Esp8266 Wifi Module".

[Gnaneshwar K, Kushal Reddy, Pranav Bhargav Reddy K R 2017-2018]

This paper designs and demonstrates an economical and easy-to-use wi-fi module and controlled irrigation system based on raspberry pi. The proposed system deals with various environmental factors such as humidity, temperature, and the amount of water required by crops using sensors such as water flow sensors, temperature sensors, and soil moisture sensors. The broadcast section of this project will be as a temperature sensor, soil moisture sensor, power supply, humidity sensor, and router are transmitted to ESP8266. The receiver section will be like from the router, relay, motor, and 16*2 LCD received by raspberry pie. The main motivation behind this project is that the system detects a lower moisture content and then automatically turns on the pump. Similarly, when we consider using this model in green farm cultivation, we can use a temperature sensor supplemented with other sensors. When the temperature inside the green farm is a bit higher than normal, they turn on the sprinklers to counter the situation.

IV. PROPOSED SYSTEM

The proposed system consists of 4 main features:

A. Internet of things:

The term IoT, or Internet of Things, refers to the collective network of connected devices and technology that facilitates communication between devices and the cloud and between devices. Thanks to the advent of cheap computer chips and broadband telecommunications, we now have billions of devices connected to the Internet. A typical IoT system works through real-time data collection and its exchange. The IoT system has three components:

i. Smart devices

This device has been given computing capabilities. It collects data from its environment, user inputs, or usage patterns and communicates the data over the Internet to and from its IoT application.

ii. IoT application

This application is a set of services and software that integrates data received from various IoT devices. Ituses machine learning or artificial intelligence (AI) technology to analyze data and make informed decisions. These decisions are communicated back to the IoT device, and the IoT device then intelligently responds to the inputs.

iii. Graphical user interface

An IoT device or a fleet of devices can be managed through a graphical

B. Blynk app:

Blynk is an IoT platform for iOS or Android smartphones that are used to control Arduino, Raspberry Pi, and NodeMCU over the Internet. This application is used to create a graphical interface or human-machine interface (HMI) by compiling and providing the appropriate address on the available widgets.

C. ESP8266:

The ESP8266 is a microchip Wi-Fi system-on-a-chip (SOC) for Internet of Things (IoT) applications manufactured by Espressif Systems. Due to its low cost, small size and adaptability with embedded devices, the ESP8266 is now widely used across IoT devices. . The ESP8266 module allows microcontrollers to connect to 2.4 GHz Wi-Fi using IEEE 802.11 bgn. It can be used with ESP-AT firmware to provide Wi-Fi connectivity to external host MCUs, or it can be used as a standalone MCU by running an RTOS-based SDK. The module has a full TCP/IP stack and provides the ability to process data, and read and control GPIOs. The ESP8266 has many applications when it comes to IoT. Here are some examples where the chip is used: • Network: The module's Wi-Fi antenna allows built-in devices to connect to routers and transfer data • Data Processing: Includes processing of basic inputs from analog and digital sensors for much more complex calculations using RTOS or Non-OS SDK • P2P connectivity: Establish direct communication between ESP and other devices using IOT P2P connectivity. • Web server: Access to pages written in HTML or development languages.

D.** Sensors:**

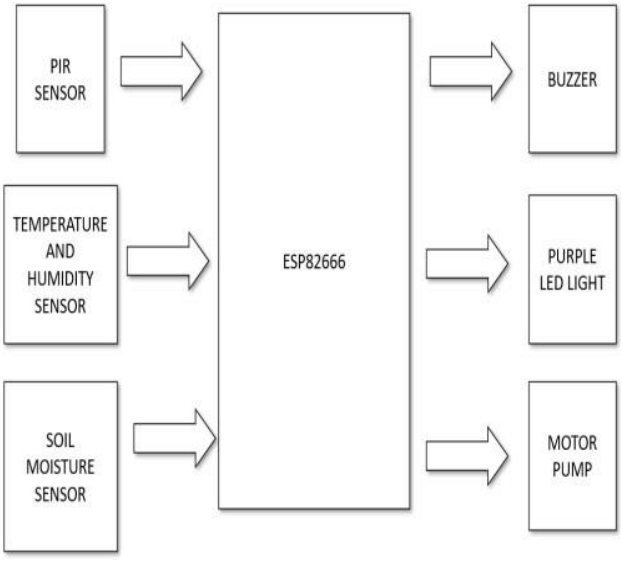
A sensor is a device that detects and simultaneously responds to the type of input from the physical environment. The input can be light, heat, motion, humidity, pressure, or any number of other environmental phenomena. The output is generally a signal that is converted to a human-readable display on a network for reading or further processing. Sensors play a vital role in this. They make it possible to create an ecosystem for collecting and processing data about a specific environment so that it can be monitored, managed, and controlled more easily and effectively. IoT sensors are used in homes, the field, automobiles, airplanes, industrial environments, and other environments. Sensors bridge the gap between the physical and logical worlds, acting as the eyes and ears for the computing infrastructure that analyzes and acts on the data collected from the sensors.

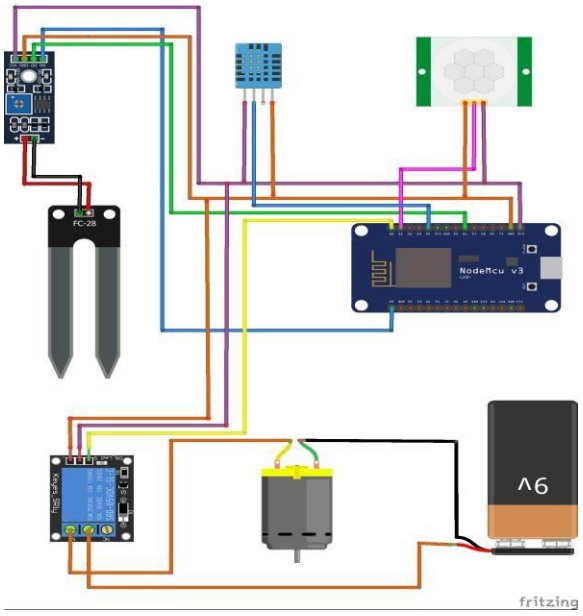
E.** Purple LED lights:**

Scientists, gardeners, and LED manufacturers have focused on the red and blue frequencies of light because these frequencies of light are two of

the most important for photosynthesis. As noted by Yan et al: Red light plays an important role in controlling chloroplast functions, stem and petiole growth, and the reproductive system. In other words, red light is important for the fruiting and flowering stages of a plant. Blue light affects plant growth, leaf expansion, and pigment accumulation. This means that blue light is important for vegetative growth. Basically, the idea behind violet grow lights is that you only focus on the most important light frequencies and forget about the rest.

Block diagram :





IMPLEMENTATION Our project

involves the following:

- to monitor the water level of our plants using soil moisture sensor along with temperature and humidity sensors
- pest detection through PIR sensor.

We will be controlling these sensors using the ESP8266 microcontroller chip.

The soil moisture sensor detects the moisture content of the plants and notifies the user to water the plants when the plant's moisture level is low. After it notifies, the user can switch on the motor pump directly from the user's mobile phone which is integrated with the IoT device.

The app to do the above is generated using the blynk application using which we can control the system through the mobile phone via the internet.

The water pump can be controlled from the mobile phone instead of constantly monitoring the plant's water level and watering it. This reduces the physical efforts and makes it more innovative and comfortable for home gardeners.

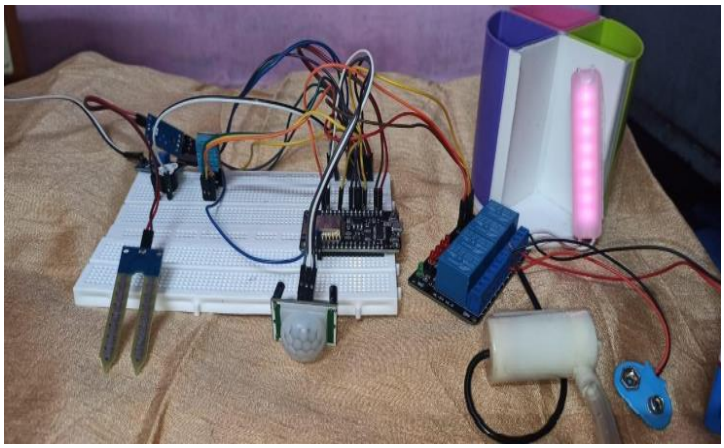
The next component used is the PIR sensor which is used to detect the movement of pests near the plants. When an animal comes near the plant, it detects the animal's movement and triggers the buzzer which shoos the animal away.

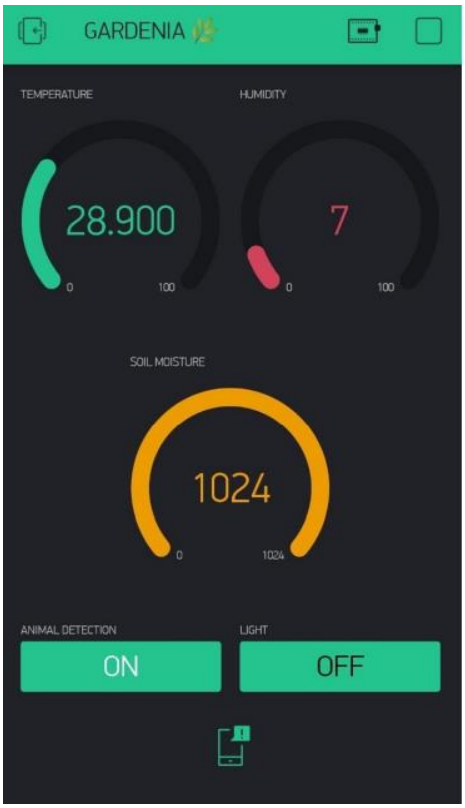
There is a high possibility for the buzzer to go off when the user goes near the plants. In order to avoid this, we can switch off the PIR sensor using the Blynk app before doing so.

Lastly, we have integrated Purple LED lights that provide enough radiation to stimulate plants' growth in the absence of sunlight.

VI. RESULTS

This work is totally based on collecting data from the data plants. The water required to make the plants thrive in extreme weather conditions is provided according to the data collected from our surroundings and the soil moisture content. In order to protect the plants, the buzzer from the PIR sensor makes sure the pests do not come near the plants. Adding on, in situations where access to sunlight is difficult artificial light provided by the purple LED lights stimulates the growth of both the leaves and the seeds.





VII. CONCLUSION

This smart gardening system has been developed to be precise and cost-efficient by using IoT.
This system creates a change in home gardening by making sure the crops by keeping tabs on the amount of water in the soil, we can make sure our precious crop stays hydrated, or we can get an idea of the conditions before planting.
This challenging and amazing experience has helped us create a system that encourages people to grow a home garden hassle-free and with less manual work in this fast-paced world to make sure we create a better future for the coming generations.

VIII. REFERENCES :

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