Grenze International Journal of Engineering and Technology, January Issue

Plant Watering Automation for Indoor Plants

B.N. Shashikala
Department of Electronics & Communication Siddaganga Institute of Technology, Tumakuru

***Abstract*— The most important task in daily operations is related to indoor plant watering. No matter whichever weather it is, either too hot and dry or too cloudy and wet, one should be able to control the amount of water that reaches the plants. The plant watering automation provides a convenient and efficient solution for watering indoor plants. The automated watering system ensures that plants receive the right amount of water at right time. This can be specially useful for busy individuals who may forget to water their plants or for those who stay away from home for extended periods. Additionally, the use of line follower robot allows for targeted watering which improves plant growth and development. The use of line follower robot with Arduino Mega reduces the risk of over or under watering. Line follower robot interfaced with IR sensors is used for path detection. A path is set and the robot moves in the set path based on the output values given by these IR sensors. Arduino AT mega 2560 is used as the microcontroller and motor driver L298N is used to control the geared DC motor wheels.**

I. INTRODUCTION

Plants helps in keeping the environment healthy by cleaning air naturally and producing oxygen. Plants are dependent on watering and right amount of sunlight to sustain life and growth. In busy schedule of day to day life, people forget to water their plants and due to this plants suffers many disorders and ultimately died. It is very essential to utilize the water resources in proper way. Manual watering requires time and effort which can be avoided with automation. Thus a system is required to handle the task of watering plants at required time and in a more targeted way. The plant watering automation for indoor plants handle this task automatically by estimating and measuring the moisture content of the existing plant and then supplies desired amount of water needed by the plant. It minimizes the excess water usage as well as keeping plants healthy.

II. LITERATURE REVIEW

An Automated plant watering system was discussed that provides low budget project which the farmers of the country can easily afford. The Automated plant watering system mainly consists of Arduino along with soil moisture sensor, water level sensor and GSM Module. The soil moisture sensor detects the water content in the soil and sends the signal to Arduino to indicate that the plants need watering. Water level sensor detects level of water in the tank. Based on the input of water level senor placed inside the tank GSM will notify the user to switch ON/OFF the main motor [1].

A smart garden automated system was proposed that provides real time watering and lighting system with security features. An RTC module is used in order to water the plants for a user defined time. Using RTC module, lights will turn on when the natural sunlight is inadequate. Sonar sensors are used to detect the motion and position of intruder and alert the user through buzzer [2]. An automatic plant watering system which is programmed to water plants in specific time predefined by user was designed.

Grenze ID: 01.GIJET.11.1.351

ATmega328 is used as microcontroller and soil moisture sensor is used to detect the moisture level of plants at particular instance of time. If the moisture content is less than specified threshold which is predefined according to particular plant's water need then desired amount of water is supplied till it reaches threshold. Generally, plants need to be watered twice a day, morning and evening. Thus, the microcontroller is programmed to water plants two times per day. System is designed in such a way that it reports its current state as well as remind the user to add water to the tank. All this notifications are made through mobile application [3]. A line follower robot for plant watering automation which has enormous potential to help people in watering plants that are arranged along a predefined path without human intervention was designed. This robot with line following and obstacle detection features along with on top water reservoir and water monitoring system is capable of watering any plants in pre-scheduled time. This will reduce cost, labor, and time and eventually it will make the watering task ease to the people [4]. An advanced farming system using an open source hardware was proposed and designed. The concept of robot farming system along with the use of line following, obstacle avoid- ance, soil moisture detecting and caterpillar chain (for ploughing) to make a robot suitable for agriculture has been implemented. As the robot continues to plough, moisture content of the soil is determined via moisture sensor where moisture content value is compared with the threshold value and accordingly water is pumped. The robot then moves further following its line and stops until the end of line or when any obstacle is detected via an ultrasonic sensor. The robot further retracts its path back to the starting point. One of the key elements of smart agri robot farming system is to make it more economical to the farmers. The system is reliable and cost effective [5].

III. System Development

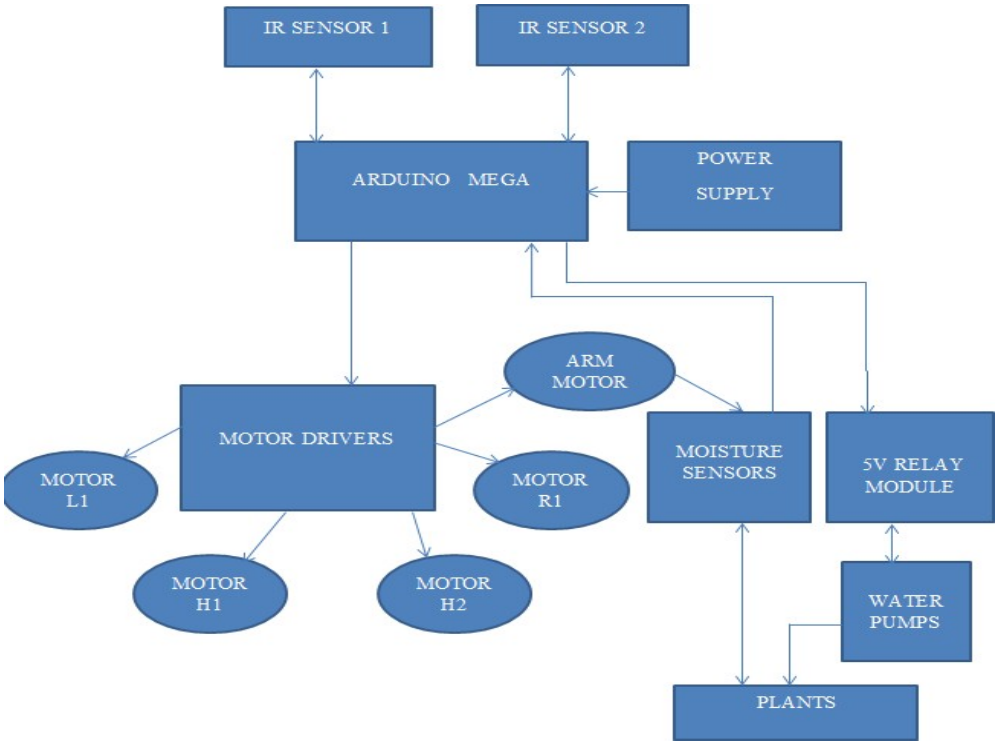

Figure 1: Block diagram of the Plant watering Automation for Indoor Plants

Figure 1 shows the block diagram of plant watering Automation for Indoor Plants from line follower robot and plant watering automation system using Arduino mega. In the system plant watering automation is done where soil moisture sensor is used to check the minimum threshold and to indicate the plant needs watering and to indicate to stop watering when the maximum threshold is reached. IR Sensor is used for detection of the predefined path for plant watering automation of indoor plants. L298N motor drivers for driving motors for the movement of line follower robot in set path and also used drive the motor which is responsible for vertical moment for plant watering automation of indoor plants.

A. Methodology

The proposed system consists of a Line Follower Robot interfaced with IR sensors for path detection. The robot can move forward, turn right,left and stop by following the path using IR sensors. Arduino AT mega 2560 is used as microprocessor. Motor driver circuit using L298N has been used for controlling four motor wheels and motor which causes vertical movement necessary for placing of soil moisture sensor into pots. A DC water pump is used here for watering plants. IR sensors are typically used to detect the contrast between a black line and the surrounding surface. The IR sensor is positioned on the line follower robot which is capable of distinguishing the line and the surface (e. g, black line on a white surface). Sensors read values continuously and provide output. The robot move forward, stops, and turns right or left based on which side has a higher sensor reading.

The stop behaviour is incorporated in the execution flow of the line follower robot by introducing horizontal path. The Line Follower robot stops as it detects horizontal path and start performing plant watering automation. Soil moisture sensors are used to detect the moisture content in the soil and according to the analog output values received by the micro-controller from the soil moisture sensor, the water is pumped into the soil. Once the automation is completed robot retracts its path.

C. System Hardware

To begin using the microcontroller, all that is required is to connect it to a computer via a USB cable or power it using an AC- to- DC adapter or battery. In plant watering automation, 14 Digital output pins and 1 analog input pin for interfacing L298N motor drivers, relay, soil moisture sensor and IR Sensors are used. H-Bridge consists of L293N IC, which has motor driver circuit. It is used to drive the geared DC motors. An infrared sensor is an electronic device, that emits IR radiations in order to sense from the surroundings, while the signal output will output digital signal (a low-level signal). It has a Vcc and a ground pin and a digital output pin. The digital output pin is given to arduino mega. Relays are electrically operated switches that open and close the circuits by receiving electrical signals from outside sources. It has transmitter and receiver.The transmitter receives input from various sources, such as soil moisture sensors and based on the input received, the transmitter generates a control signal that indicates whether watering is required or not.The receiver is connected to the water supply system, such as a pump. This soil moisture sensor module is used to detect the moisture of the soil. It measures the volumetric content of water inside the soil and gives us the moisture level as output. The module has both digital and analog outputs and a potentiometer to adjust the threshold level.

D. Flowchart of line follower robot

Figure 2 shows flowchart of line follower robot. When IR Sensor detects the predefined path, it passes the further information to the Arduino mega. It decides whether the robot should go left, right, straight or stop according to the path set.

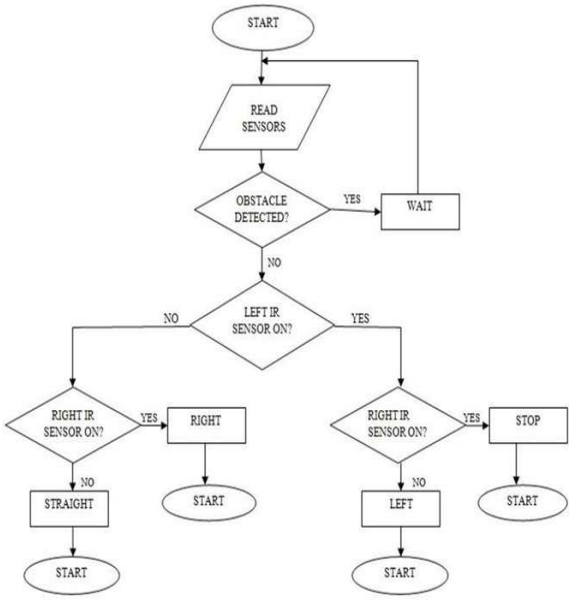

Figure 2: Flowchart of line follower robot

Table 1 depicts the direction of wheels based on Input. In this table, IN1, IN2, IN3, and IN4 refers to the inputs of L298N Motor Driver.
Case 1: If IN1, IN4, are high and IN3, IN4 are low, then the robot will move forward. Case 2: If IN2, IN3, are high and IN1, IN4 are low, then the robot will move backward.
Case 3: If IN1, IN3, are high and IN2, IN4 are low, then the robot will turn right. Case 4: If IN2, IN4, are high and IN1, IN3 are low, then the robot will turn left. Case 5: If IN1, IN2, IN3, and IN4 are low, then the robot will stop.

TABLE I: DIRECTION OF WHEELS BASED ON INPUT

Direction	IN1	IN2	IN3	IN4
Forward	High	Low	Low	High
Backward	Low	High	High	Low
Right	High	Low	High	Low
Left	Low	High	Low	High
Stop	Low	Low	Low	Low

E. Flowchart of Plant Watering Automation System

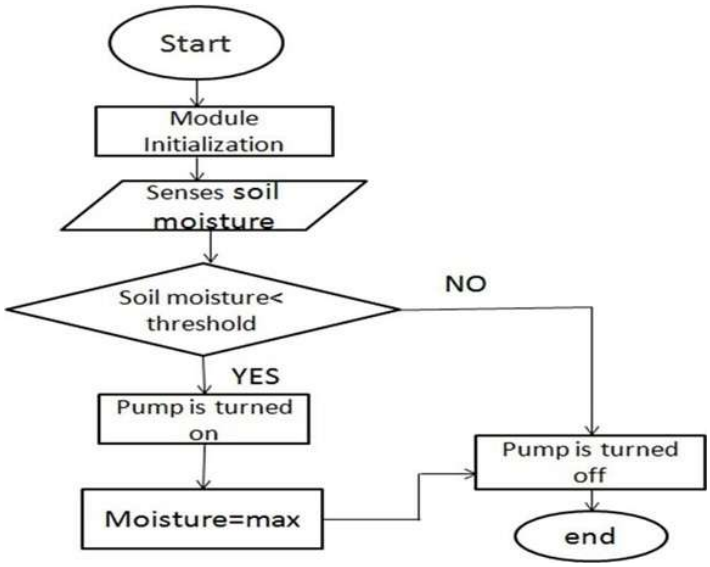

Figure 3: Flowchart of plant watering automation system

Figure 3 shows flowchart of plant watering automation system. In this proposed system, plant watering automation is done. The Soil moisture sensor is kept inside the soil to measure the moisture content in soil. When the moisture of the soil is less than the minimum threshold, then the pump is turned on and the water will be pumped until the moisture level of the soil reaches maximum threshold. This process repeats for every indoor plant.
Arduino IDE is an open-source software. It provides a user- friendly interface for writing, compiling, and uploading code to an Arduino board. It comes with a simplified programming language based on C++ that is easy to learn and use. The IDE includes a text editor that supports syntax highlighting, auto-completion, and error highlighting. It also includes a built-in serial monitor that allows users to send and receive data between the computer and the Arduino board.

IV. RESULTS

The Plant Watering Automation system successfully watered plants detected by the sys- tem. The plant received the right amount of water.
Figure 4 shows Line follower robot stopping at horizontal line. Robot follows the pre- defined path according to the output given by IR sensor and stops whenever horizontal line is detected where the plant is placed.

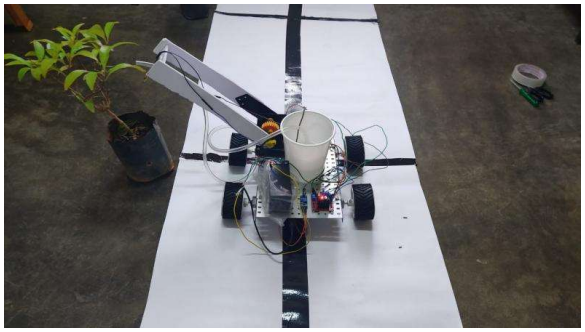

Figure 4: Line follower robot stopping at horizontal line

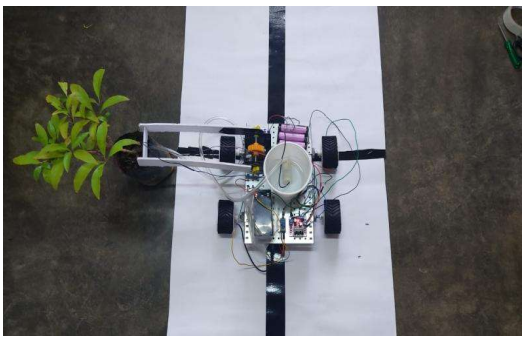

Figure 5: Robot sensing soil moisture and watering the plant

Figure 5 shows Robot sensing soil moisture and watering the plant. When robot stops nearby plant, it detects moisture content of the soil by placing soil moisture sensor into the soil and waters accordingly. After the watering is done, the moisture content in the soil reaches a threshold value. Once the automation is completed, the robot arm retracts its motion and the robot moves forward.

V. CONCLUSION

The Plant watering automation for Indoor Plants is successfully implemented and tested. This system replaces manual watering with a switch to operate by making it hands-free. The line follower robot, equipped with high precision sensors, diligently navigate their way to each plant and deliver optimal amount of water with precision. By maintaining optimal moisture level, the system promotes healthier plant growth and minimizes the risk of diseases caused by improper watering. Overall it combines resource conservation, and time savings, making it a valuable tool for plant care in both domestic and commercial settings.

REFERENCES

[1] M. Mayuree, P. Aishwarya and A. Bagubali, "Automatic Plant Watering System," 2019 International Conference on Vision Towards Emerging Trends in Communication and Networking (ViTECoN), pp. 1–3, doi: 10.1109/ViTECoN.2019.8899452, 2019.

[2] Md. Adib Muhtasim, Syeda Ramisa Fariha, Ashique Mohaimin Ornab, "Smart Garden Automated and Real Time Watering and Lighting System with Security Features," 2018 International Conference on Computing ,Power and Communication Technolo- gies, Sep 28-29 , pp. 676–679, 2019.

[3] D. Divani, P. Patil and S. K. Punjabi, "Automated plant Watering system," 2016 International Conference on Computation of Power, Energy Information and Com- muincation (ICCPEIC),pp. 180-182, doi: 10.1109/ICCPEIC.2016.7557245, 2016.

[4] R. H. Rafi, S. Das, N. Ahmed, I. Hossain and S. M. Taslim Reza, "Design and implementation of a line following robot for irrigation based application," 2016 19th International Conference on Computer and Information Technology (ICCIT), Dhaka, Bangladesh, pp. 480-483, doi: 10.1109/ICCITECHN.2016.7860245, 2016.

[5] Butool Abidi, Simran Kodwani, Aishwarya Mathur, Kashyap Joshi, "Smart Agri- Robot", International Research Journal of Engineering and Technology (IRJET)," IEEE Trans. Image Process., Vol 07, Issue 07, 2020.