AUTOMATIC PLANT WATERER

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1B

Introduction to Electrical-Electronics Engineering Project Report

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CONTENTS

ABSTRACT

In order to grow plants, it is very important to provide suitable conditions for them. Some of the suitable conditions are that the plant receives sunlight, that the soil is rich in minerals and that it is adequately watered. In order for the plant to grow in a healthy way, the moisture rate of the soil it is in must always be balanced. If the humidity is too little or too much, the plant will wilt or rot, in short, the plant will die. With this proposed system, the moisture level of the soil where the plant is located will be measured, and if it is low, water will be given to the plant until the humidity level is required.

Keywords: plant, soil moisture sensor, irrigation

1. INTRODUCTION

Plants are a very large realm of living things that can produce their own food by photosynthesis and contain many organisms (trees, shrubs, flowers, grasses, mosses, etc.) [1]. Plants are very effective on natural events such as flood prevention and climate control. For example, plants reduce the possibility of floods and landslides by slowing down the flow of water in waterways, rivers, and roadsides. Plants are also very important to the ecosystem because they form the basis of almost every ecosystem's food chain. For example, a beetle feeds on a plant, then the bird eats the insect, another predator eats the bird, and so on [2]. Humans, including the first human, met their nutritional needs from plants, and they still continue to meet them [3]. In the Neolithic Period, when stone tools were developed and the Ice Age ended, people began to obtain products by cultivating the soil, and this is called agriculture. [4]. Afterwards, with the development of science and technology, the most suitable conditions were provided for plants and plant cultivation began to be done on a much larger scale and with a wide variety. Some important factors affecting plants are light, climate type, soil structure and biological factors [5]. Apart from these, irrigation is also very important.

Water ensures the transport of nutrients throughout the plant and allows the plant to stand upright. If there is no proper water balance, the plant can not be fed adequately and become physically weak and cannot carry its own weight [6]. To prevent this, automatic plant waterers have been produced. In the study [7], with the help of Arduino Uno, the plant was irrigated at certain time intervals. In study [8], soil moisture was measured using a soil moisture sensor and water was transferred to the plant using a dc motor. If the sensor detects insufficient humidity, the dc motor is started and the plant is given water until it reaches the sufficient humidity level. In the study [9], the humidity sensor was used as in the previous study, but this time a servo motor was used to pump the water.

In this study, a system will measure the moisture content of the soil where the plant is located and if the humidity is insufficient, it will pump water to the plant until the moisture level is appropriate. In the second part of the study proposed method and component list are given, the third part, application details are explained, and in the last part the results are given and future studies are mentioned.

2. METHODOLOGY

In order to grow plants, it is very important to provide suitable conditions for them. Conscious irrigation is also a very important factor for growing plants. Therefore, the moisture

of the soil should be suitable for the plant, that is, the plant should neither be without water nor in too much water.

In this study, a soil moisture sensor was used to measure the moisture of the soil in which the plant is located. If the sensor detects less humidity than it should be, the water pump operates and waters until the appropriate humidity level for the plant is reached. The flowchart of the study is given in Figure 1.
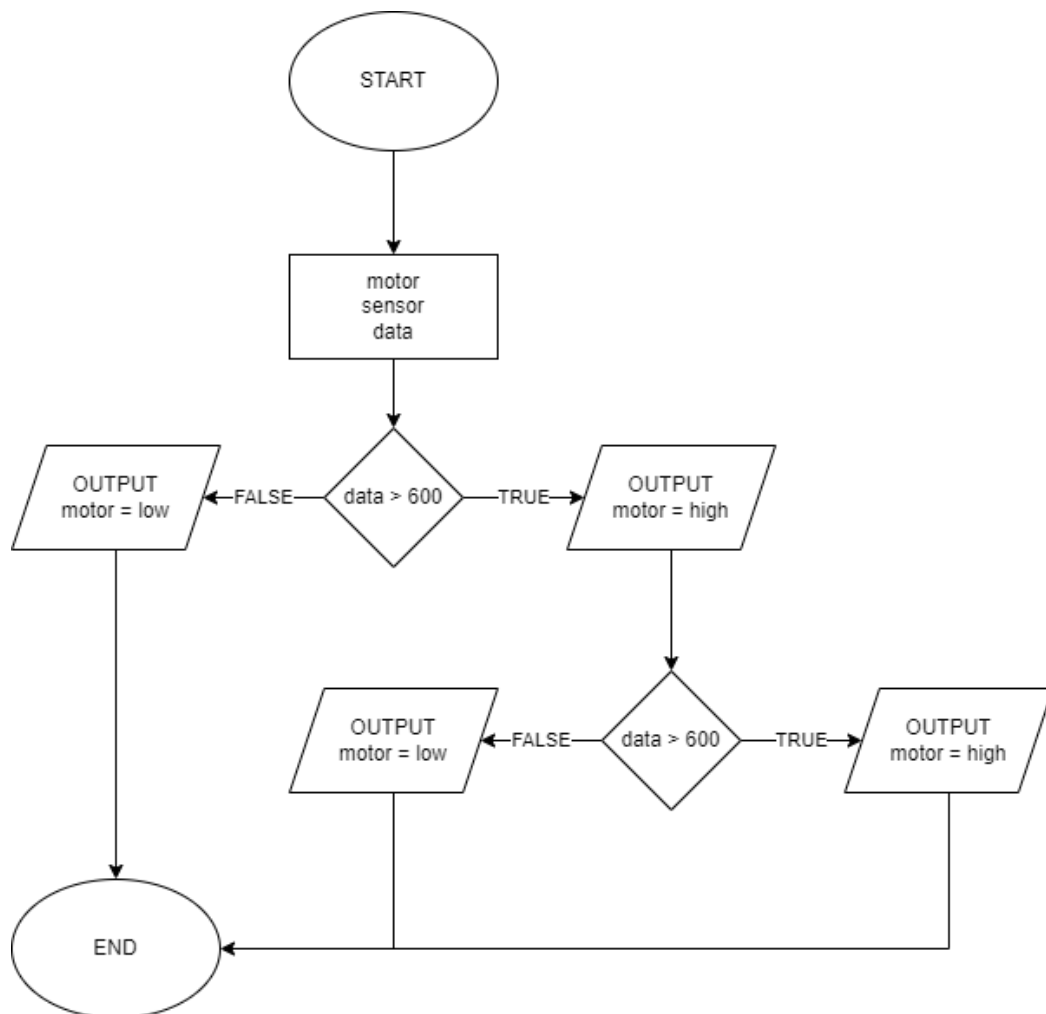

Figure 1. Flowchart of the System

In this study, the required voltage value for the water pump was adjusted with a step up voltage booster regulator. The system is powered by a 3.7 volt Li-ion battery. Li-ion charging module is used to charge the battery and switch is used for on/off. The block diagram of the system is given in Figure 2.
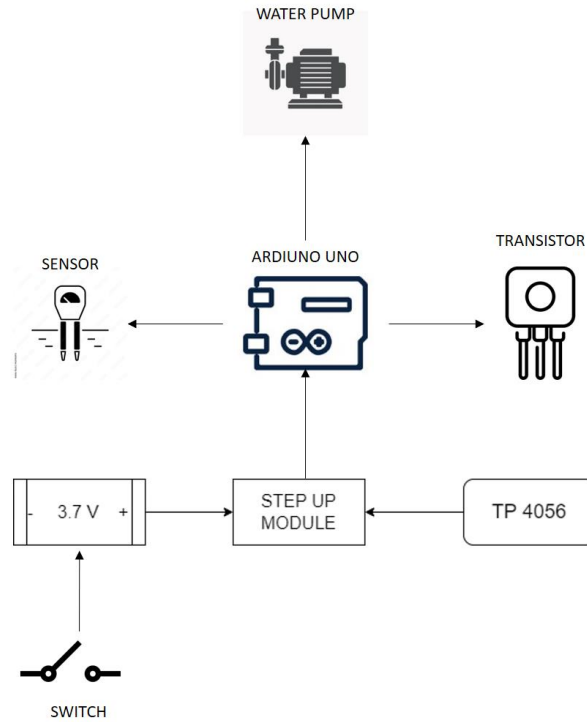
Figure 2.Block Diagram of the System

2.1. ARDUINO UNO

Arduino is an open source and microcontroller platform that enables electronic applications to be made easily. The Uno model used in this study, which has Atmega328p microcontroller chip, is given in Figure 3.

Figure 3. Ardiuno Uno

Some important features of Arduino Uno are given in Table 1.

Table 1. Some Features ofArduino Uno[10]

Microcontroller	ATmega 328	Clock Speed	16 MHz
Oparating Voltage	5V	Input Voltage	7 – 12 V
PCB Size	68 x 53 mm	DC Current per I/0 pin	40 mA
Digital I/O Pins	14	Analog Input Pins	6

2.2 X14.86062 SOIL MOISTURE SENSOR

Soil moisture sensors are sensors that can measure the moisture level of the soil and also measure the level of small amounts of liquids. X14.86062 is a sensor used to measure the amount of moisture in the soil or the level of small-scale liquids [11]. The sensor is given in Figure 4.
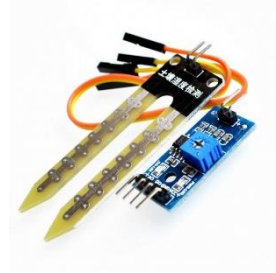

Figure 4. X14.86062 Soil Moisture Sensor

The VCC leg of the sensor is connected to the + 5V pin of the Arduino to feed the sensor. GND pin is used for grounding and A0 pin is connected to Arduino's A0 pin. Some important features of the sensor are given in Table 2 [11].

Table 2. Some Features of X14.86062 [11]

Oparating Voltage	3.3 – 5 V	Current	35 mA
Output Voltage	0.4 – 2 V	Output Type	Digital and Analog

2.3. K22.SOLEPOMP SOLENOID WATER PUMP

Water pumps are the machines that convert the electrical energy into hydraulic energy and allow to the liquid to be transmitted up to a certain height or in the desired direction. K22.SOLEPOMP is a water pump used for liquid transfer and has very low power consumption, as given in Figure 5 [12].
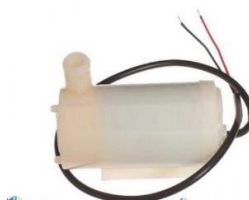

Figure 5. K22.SOLEPOMP Solenoid Water Pump

One of the cable ends in Figure 5 is connected to the Vout part of the Step Up module and the other is connected to the base of the transistor. Some important features of K22.SOLEPOMP is given in Table 3.

Table 3. Some features of K22.SOLEPOMP [12].

Oparating Voltage	3 – 6 V	Maximum Lift	40 – 110 cm
Flow Rate	80 – 120 L/H	Size	24 x 45 x 33 mm

2.4. MT3608 STEP UP VOLTAGE BOOSTER REGULATOR

MT3608 is an amplifier board designed for Ardiuno that can increase the input value in the range of 2 -24 volts up to 28 volts. The battery in the circuit has a voltage of 3.7V, but a voltage of 6V is needed for the water pump to work. The MT3608 which is given in Figure 6. is used to raise the 3.7V voltage to 6V.

Figure 6. MT3608 Step Up Voltage Booster Regulator

2.5. TP4056 LITHIUM LIPO BATTERY CHARGER MODULE

TP4056 is a product that allows us to charge 1-cell lithium batteries and batteries connected in parallel with USB. It is used to charge the Li-ion battery in the circuit and has a Type C output. It is given in Figure 6.

Figure 7 TP4056 Lithium Lipo Battery Charger Module Circuit

2.6. 18650 LI-ION RECHARGEABLE BATTERY

Li-ion batteries are rechargeable batteries. 18650 which is given in Figure 7 is a rechargeable Li-ion battery with a voltage of 3.7 V and current of 2000 mA.

Figure 8. 18650 Li-ion Rechargeable Battery

2.7 TRANSISTOR and SWITCH

Transistor is a semiconductor circuit element used to amplify or switch weak electrical signals. Switch is the circuit element that cuts the current in the circuit or changes the direction of the current. Usually has I/O or ON/OFF icon.

3. EXPERIMENTAL RESULTS

In this study, the soil moisture sensor will measure the moisture level of the soil. If there is not enough moisture in the soil, the water pump will be activated and water the soil until the moisture level reaches a sufficient level. In this content, the soil moisture sensor was first tested. After this test was carried out successfully, the voltage coming from the battery was increased with the step-up module and reached the voltage value suitable for the water pump. Afterwards, necessary connections were made in the circuit and a charging module was added so that the final product could be used for a long time. As a result, the system completed successfully. The final state of the system is given in Figure 9.

Figure 9. Final State of the System

The referance [13] can be visited for the source codes of the study.

The referance [14] can be visited for the presentation video of the study.

4. CONCLUSION

Irrigation is a very important factor for plant breeding because if the plant is watered less or more than it should be, this will negatively affect the development of the plant and even can cause it to wilt. In this study, the moisture level of the soil where the plant is located will be measured by the sensor and if it is low, it will be watered with the help of the motor. In this way, the plant will always be in a soil containing moisture at the required level and will be able to develop healthier and faster. In addition, if the plant cannot be taken care of for a long time, the plant will not be harmed because the system will water the plant for a long time since the system can be charged. In future studies, bluetooth or wireless module will be added to the system and e-mail will be sent to the mobile phone. In addition, the moisture level of the soil can be displayed on the screen using an LCD screen. Besides, an ultrasonic sensor can be used to measure the level of the water source in which the water pump is located.

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