Design and development of a weather-based automatic irrigation system for conventional farming

Microprocessor and Embedded System

1. Introduction

1.1. Background of Study

Agriculture is the country's backbone and is intertwined with its food security. Bangladesh's government's 'Vision 2021' calls for the country to achieve food self-sufficiency by 2013 and to feed everyone. The most important concern is increased agriculture output, which is caused by increasing population expansion. Aside from food security, the industry contributes around 12% of GDP and employs 44% of the workforce in the country. For these reasons, the government has provided the agriculture sector lot of emphasis. The agriculture sector is intimately tied to rural poverty since this helps the livelihood opportunities of the rural poor, who make up a significant portion of the population. [26] - [28]

Bangladesh's agriculture industry is a major source of revenue and employment. Subsistence farming is practiced by the majority of the farmers. Crop production increases rural income and provides employment for the impoverished [41]. The country, which is trapped between both the Himalayas and the Bay of Bengal, is prone to natural calamities. Climate change has increased the severity and frequency of salinity, storms, droughts, erratic rainfall, high temperatures, flash floods, and other global warming-related events. Tropical countries' crops are being harmed by global warming. As a result, one of the biggest issues in Bangladesh is weather forecasting, which has an impact on people's quality of life and activities. Collecting previous and current information regarding the weather condition as it is understood today [4] - [6] is quite challenging. Bangladeshi farmers may find it beneficial to water their already-grown crops before they get damaged.

The bulk of irrigation equipment are now operated manually. In a sensor-based irrigation system, the humidity sensor includes the calculation of water vapor in the atmosphere, which effects current flow through the soil, while the temperature sensor records the temperature in the land area. The Grove 128*64 OLED display shows the value of these two sensors. [16] - [18] [19].

Agriculture has grown steadily throughout the years, owing primarily to climate change. However, if steps are implemented, higher growth may be feasible. As a result, to make agriculture viable in Bangladesh, efficient irrigation water utilization and effective irrigation facilities are essential. A dc motor appears to be more environmentally friendly. If irrigation systems are automated, farmers may be able to water crops more effectively and safely during seasons with fewer outages. By saving resources like water and power, our strategy will help small farmers improve their livelihoods [28] - [30]. Farmers in climate-vulnerable locations can use efficient irrigation systems to adapt and strengthen their resilience to climate change.

1.2. **Motivation**

Agriculture is a tool that can help to ensure food security. With the growing need for food, it's vital that we keep the correct balance in order to grow the right quantity of crops. Despite the fact that agriculture is critical to our country's survival, we are unable to effectively use its resources. The principal culprits include climate change, water waste, and a shortage of land reservoir water. Farmers use 35 percent of 100 liters of water for vital irrigation and misuse the remaining 65 percent, according to Lutfor Rahman, Chief Engineer of Bangladesh Agricultural Development Corporation, resulting in billions of tones of water squandered each year [2]. Furthermore, repeated water extraction from the soil lowers the water level in the soil, resulting in an increase in unirrigated land zones. Agriculture is the most susceptible industry since its output is impacted by environmental conditions including temperature, air pressure, humidity, and rainfall, which are all expected to be unpredictable. To overcome these challenges, we devised a system that employs DHT11 sensors to accurately anticipate weather while also decreasing water waste by shutting down the engine when necessary. Farmers may utilize our method to carry out irrigation tasks in a cost-effective and resource-saving manner. Food is one of our most fundamental requirements, hence the pivotal role in our economy has been mentioned at first. As a result, the prior data supplied by Bangladesh agricultural statistics are presented for adequate irrigation. The intricacies of each component are then briefly addressed. Following that, a circuit schematic of the project's implementation was provided. The project's functioning concept and outcome were then addressed. Following that, we addressed the project's influence on our society and environment.

1.3. **Project Objectives**

The demand for food is growing every day, but the proportionate increase remains the same. All agricultural commodities are getting extremely expensive in this epidemic condition. Because of the reducing cost and increase of agricultural crops, an automated system is highly vital and necessary in the agriculture area. In this system, we employed two types of sensors. The DHT11 Humidity and Temperature sensor is the first, while the BMP180 Digital Pressure Sensor Breakout Board is the second. The primary goal of this article was to enable farmers to grow the same amount of crops with less water, hence saving energy. This paper's strategy also encourages environmental stewardship.

1.4. **A brief outline of the report**

We utilized Proteus software to implement our simulation in this project. Design and development of a weather-based automatic irrigation system for conventional farming is implemented in this program. To begin, we used simulation devices such as the Arduino Uno R3, DC Motors, LED lights, DHT11 temperature sensor, BMP (Barometric Pressure)180, and everything from the Arduino, Grove simulation library. The flow chart is then created in order to accommodate all of the arguments and working stages. The setup phase of the flowchart was then created, with all LEDs turned off and the argument circumstance set to false. The condition was then designed on the second page, which was then discussed in detail in the implementation section. A true false operation was included in this simulation, allowing it to determine if the weather is sunny, sunny/cloudy rainy, or unknown. We applied the unknown special condition to highlight that the weather status range is not linked to any other circumstances. The temperature was also measured with the help of a temperature sensor. And there was a two-second delay in the display. If the weather pressure is more than 995, the status is rainy, and the green light is turned on; if it is 1000 to 10004, it is yellow, and the weather is sunny/cloudy; and if it is 1005 and above, it is red, and the weather is sunny.

2. Literature Review

Closed loop control and sensor feedback in an automated irrigation system might help match water supply to crop demand and prevent waste [1]. The system's aim is thwarted when an excessive quantity of water is regularly applied to the crop, or when an inadequate amount of water is constantly applied to the crop. The output of the Humidity and Temperature sensor-based systems is sent through an A/D converter, which converts it to digital domain before feeding it to the controller for further processing. [2]. Aside from that, today's Automated Irrigation Systems collect data from the field and weather using a sensor network. On his cell phone, the farmer receives the relevant information of a [3].

On the other side, the technology improved water saving by employing a meteorological forecast that takes data from a webpage about rain predictions and distributes adequate water for certain crop and soil combinations" [4]. However, it ran into problems obtaining real-time data. Irrigation systems based on humidity detectors and soil moisture [5] and solar-powered irrigation systems [6] have also had a significant influence on the irrigation process.

First and foremost, the world's water resources are vanishing. Robotized Drip Irrigation is the unequaled solution to this problem. The developed water system technology eliminates the need for craftsmanship in both floods and trickle water systems. Direct programming allows us to

disperse available water to harvests if and only if there is a great demand for water to the harvest in order to achieve the most benefit for the least money [13].
Water scarcity causes plants to wilt before visible wilting, consumes more water, and causes the water delivery to the land to be delayed, causing the crops to dry up. This problem might be fully remedied if we used Automation Irrigation, which only watered when there was a strong need for water, as indicated by soil moisture [17]. The gadget regulates monitoring depth of the water on a regular basis to ensure that the plant or crop gets the exact amount of water it requires. The device maintains a record of the soil's temperature and humidity in order to preserve the soil's nutritional content under control for optimal root growth. The sensor conveys a signal from the field to the person if the quantity of water available increases or decreases, and the operator controls the pump to regulate or turning off the phone [18]. On the other hand, a computerized Sunlight-based water system control framework was employed to save water in smart cities, and the framework is also using the Internet of Things to keep up with connection between the water systems land and rancher. The GSM framework displays SMS and maintains a relationship between the homestead unit and the rancher's cell phone. To provide the precise benefit of wetness, temperature sensors and soil sensors are used, after which the valve in the framework is switched on/off. [21].

There is a revolutionary technique in the world of solar energy. There has been a demonstration of the concept. The irrigation system's energy is generated by photovoltaic panels. Farmers will see energy from the sun smart irrigation as the way of the future, as well as a solution to the energy crisis. As reported in this paper, the solar-powered system uses the Sine PWM technique for inverter operation with minimal harmonics, which enhances the system's efficiency [11]. Despite the fact that this method uses renewable energy, it has some drawbacks, including a high initial cost and a big footprint. A unique system for monitoring soil moisture levels has been devised using a wireless sensor network. That is how the project's architecture was presented, as well as the decisions that were made using real-time data. It has several disadvantages as well, such as maintenance issues and complicated installation [23]. There is an enhanced automated irrigation system that is based on a GSM-based prototype. The key advantage of this method is that it provided a summary of data and a schedule for the irrigation operation. The authors created a low-cost programmable automation controller (PLC) irrigation system in order to raise the market's economic level. This also resulted in the development of an irrigation water based on the Internet of Things and Artificial Intelligence [20].

Remote Measurement and Analysis System for Greenhouses GSM-SMS was used to develop a remote measuring and analysis system for greenhouses. Information is sent by SMS across the GSM network between the remote end and the targeted system. [10]. This research [16] describes the usage of a remote sensor network for a low-cost remote controlled and verified water system design. Remote Measurement and Analysis Solution for Greenhouses The proposed system included a GSM-SMS remotely measurement and analysis system for greenhouses, which again was based on just a Computer database system coupled to a GSM-SMS station. Whenever the user is within a few meters of the chosen system, a Bluetooth is also connected to the main micro controller, which reduces SMS costs. The alert Message may be delivered to the User-specified Mobile phone automatically in an IOT alarm system based on SIM900A through the system settings, regardless of the user's location [22].

When compared to normal water system practices, Torsi meters and granular lattice sensors (GMS) to inundate tomatoes conserved water. More research is needed to redo this type of study, and future studies should be conducted on a larger scale to determine the effectiveness of programmed water systems against manual water systems [15]. These systems transform the way field resources are managed. For mobile devices, a software stack called Android was built, which combines an operating system, networking, and critical apps. As an irrigation control system, this program makes advantage of the GPRS function of a mobile phone. Water management decisions are supported by the system [19]. First and foremost, the world's water resources are vanishing. Robotized Drip Irrigation is the unequaled solution to this problem. The developed water system technology eliminates the need for craftsmanship in both floods and trickle water systems. Furthermore, direct Programming aids us in the proper management of readily available water [13]. We will utilize a microcontroller in our Automated Irrigation to solve this problem.

Information and communication Through the successful sharing and trade of data across various platforms, such as the Internet, innovation has contributed to the improvement of multiple domains, particularly in the horticulture area.[25] An IOT platform based on Thing Speak and Arduino is created and tested with the goal of the rancher being able to control the water system from anywhere and at any time using a computer or mobile phone, to monitor the water boundary and reduce his efforts while also increasing water usage [40]. Using a soil dampness sensor and a Esp8266 NodeMCU-12E, this article aims to plan a rudimentary water siphon regulator. NodeMCU-12E manages a water siphon activity based on the state of soil dampness content and displays the dirt dampness sensor information and water siphon status on a website page or adaptable application. To address the previously described agricultural water system issue, a safe, adaptive, trust-capable, and sensible framework is constructed [41]. The goal of this research is to demonstrate how sensors and ecological data from an Internet of Everything may be used to manage and monitor a sun-oriented controlled smart water system architecture (IoE).

To govern the water system framework, the expected benefits of water level, climatic figure, wetness, temperature, and water system information are used [42]. Dielectric wetness sensors are particularly well suited for use in nursery soilless creation water systems. Recognizing the practical effects of substrate water content set focuses on crop execution is critical for sensor-based water systems to be successful. We designed and created a cloud-based model for a remote, sensor-based water system on the board, then tested it on basil in a perlite-coco soilless substrate under nursery conditions. The sensors used were dielectric dampness/saltiness sensors. The findings show that using a remote sensor network to continuously assess substrate water status combined with precise data on the effects of water accessibility levels on plants is a feasible apparatus for nursery soilless basil water system administrators [43]. The purpose of this study is to demonstrate how to create a ZigBee remote sensor network for use in smart water system frameworks. Following a brief overview of the major features of the ZigBee standard as they relate to Wireless Sensor Network (WSN) activities, an Arduino-based sensor hub for securing soil moisture and air temperature is demonstrated. Waspmote is designed to communicate only with Xbee switches and end devices. The suggested engineering allows for flexible execution with a robust data flow that provides critical data for autonomous decision-making in smart water system frameworks [44].

The irrigation system that was put in place was determined to be viable and cost-effective in terms of maximizing agricultural water supplies. The designed automated irrigation system demonstrates that water consumption may be reduced for a given amount of fresh biomass output. The utilization of solar electricity in this irrigation system is appropriate and crucial for organic crops. The Internet-controlled duplex communication system is a strong decision-making device idea that may be adapted to a variety of agricultural circumstances [45]. The Microcontroller-based Automated Irrigation System efficiently monitors and manages all drip irrigation system functions. The Microcontroller Based Automated Irrigation System is a useful instrument for exact soil moisture control in highly specialized greenhouse vegetable production, as well as a simple and precise irrigation approach. It also saves time, eliminates human mistake in regulating available soil moisture levels, and maximizes net earnings [46].

To control drip irrigation, a Desktop automation system was developed. Irrigation is the technique of injecting water into a portion of the soil profile that serves as the root zone. A moisture in the soil sensor is used to measure moisture in the soil and adjust irrigation according to the crop's needs. Irrigation water management best practices may assist boost efficiency and consistency while reducing pollution of water supplies [47]. During the course of the research, the group was able to develop a concept for an automated irrigation system that employs a thermoelectric generator as a soil moisture sensor and watering based on the temperature differential between the air and the soil. The team was able to demonstrate that soil temperature is directly related to soil moisture or water content [48].

It is plain to see how this automated irrigation system, which not only regulates water delivery based on soil moisture but also takes weather conditions into account, has improved water efficiency. Further research is required to undertake these types of inquiries in order to make water consumption more effective through the use of autonomous irrigation systems [49]. This research focuses on a cost-effective smart irrigation system that an intermediate farmer may utilize on his property. The goal of this work was to use a water level sensor to automatically regulate the water motor and select the direction of water flow in the pipe. A prototype for completely automated irrigation motor access, using a number of sensor nodes located in various directions throughout the agricultural area. The Pi - based is used to transmit messages to the microcontroller process via internet correspondence [50].

One such innovative technology that can assist our country in reducing the overall impact of poor water management in agriculture is the Internet of Things. Wireless communication connects local nodes to a centralized node. This centralized node is linked to a Cloud Server, which will store and handle the data received. The user may study and monitor the irrigation system using cloud-based data analysis and monitoring, which gives them access to the system from anywhere in the world [51]. Their technology can give the right amount of water to the plants based on moisture, light, and temperature conditions measured by sensors. The farmer will be able to keep track of the parameters using a mobile app that is linked to cloud storage. We can easily identify a strategy to preserve water by studying and comparing previous year's data with our current data [52]. The suggested system in this study is based on IoT and leverages real-time input data. The smart irrigation system utilizes an Android phone to monitor and manage drips remotely via a wireless sensor network. For communication between sensor nodes and base stations, Zigbee is employed. Sensing without wires Controlling air humidity, soil moisture, and temperature is easier using a ZigBee network [53].

Water availability to the crop is monitored using sensors in the automated system, and watering is done as needed using controlled irrigation. Cloud computing is an appealing answer to the vast quantity of data created because of its nearly endless storage and processing capabilities, as well as its quick elasticity. The objective is to concentrate on variables like temperature and soil moisture. The major goal of this project is to use a Smartphone to manage the water supply and monitor the plants [54]. Effective control of water usage and electricity consumption of irrigation systems may be achieved with the enhancement of technical infrastructure. This may be accomplished by allowing the irrigation system to recognize and water certain locations. This study describes a smart irrigation system that determines when and where watering is necessary based on environmental data. Microcontrollers, sensors, and the integration of water pumps with the decision-making system make up the system. An aggregated network of water sprinklers and sensors makes up the smart irrigation system. The sensor and the microcontroller interact through Bluetooth.

Smart sprinkler is an integrated system that includes a microprocessor, servomotor, sprinkler, and Bluetooth. The ssp is identical to the SDA, with the exception that it lacks a sensor. Sensor data from each sensor is gathered and reviewed at predetermined times. If irrigation is necessary, the request is solely made to the SSP [55]. They devise a mordant sprinkling phrase flourished on Raspberry Pi IoT movement. The approach must be used to manually capture the Aqua motive and can further instruct the arbor's health by using a webcam [56]. IoT is a distributed network of objects or devices that may communicate with one another through the internet. IoT plays an essential part in the plantation sector, which is expected to feed 9.6 billion users by 2050. Mordant cultivation arsenals to reduce attenuation, productive manure vogues, and so increase harvest production [36-39]. In this paper, a system for advising grain-land behaving sensors (ground wetness) and automating the sprinkling method is demonstrated. If the moisture of the venue goes below the portion, the sprinkling is automated. This strategy will be critical in places where demand is high and requires more skill than the old method [57].

A processor, a transmitter, and a collection of sensors make up a system. For the AT command interface, this system employs a cellular network with a specialized GSM modem. A field Scout TDR 300 moisture in the soil meter is utilized in this setup. The field scout android application was created for this purpose, and it instantly collects and displays data from a Bluetooth device on a smart phone. To automate the irrigation system, a remote control application is utilized to control the induction motor pump, which irrigates the land with water. Missed calls are received from the user's mobile phone in order to complete a certain job. Various operations may be conducted using a microcontroller system, such as detecting temperature, voltage, and humidity to regulate the occurrence of faults in motors due to parameters. The flow of liquid in the pipe is monitored using a liquid level sensor. Irrigation may be done efficiently with the use of a soil moisture indicator and an automatic irrigation pump system [58]. A wind energy robot is used to photograph the state of crops using a strong camera and sensors. The authors introduced a strategy in which they used solar energy to do irrigation. They produced energy for the irrigation process using pV panels. A prototype for an automated watering system based on GSM has been suggested. The first significant step in the circuit is to create a wirelessly operated robot by combining the Bluetooth module with an Arduino board that is then connected to an application. Excess water wastage may be avoided by employing the proposed automated irrigation system instead of the manual technique. The proposed automated controlled robot is controlled wirelessly through various instructions, and the field data is shown remotely on the farmers' mobile phones and computers [59].

For ages, direct linking of agricultural processes with renewable energy sources has been contemplated. It lowers energy costs by utilizing the free energy provided by renewable energy sources and frequently going off the grid, either in a micro grid or as energy autonomous islands. Agricultural operations entail a number of key energy-related activities [31-35]. However, establishing a robust and sustainable electrical power grid that allows for the use of renewable energy sources to meet these sectors' energy needs, resulting in their electrical autonomy, remains a difficult problem. The pumped water is kept in a surface reservoir or an upper Underground well [60]. In a smart WSN for a rural setting, there are primarily two modules: a field module and a control module. The control unit for both modules is a Spartan3A FPGA board. This board has an analogue - to - digital, a digital - to - analog converter, and an LCD onboard. Analog moisture sensors are connected to the Spartan3A board through the inbuilt ADC in field modules, and these sensors are used to gather moisture data from agricultural fields. The motor in the control module is connected to the FPGA through an inbuilt DAC, and its speed is adjusted based on sensor data obtained from the field module, which is also shown on the inbuilt LCD. The FPGA-based water distribution senses and monitors the agricultural environment in real time. As a result, this system is easier to use and offers effective water distribution. They may also start collecting data of moisture percentage in soil from the display and utilize this information to determine field requirements [61].

In many third-world nations, agriculture is critical to long-term development and poverty reduction. In conclusion, while making irrigation decisions, the bulk of previously built irrigation systems do not take into account forecasted weather conditions [30]. A few writers focused on weather, environment, and soil conditions prediction, but not in the context of constructing smart agriculture systems. As a result, enormous volumes of water and energy are lost, resulting in crop failures (due to excess water) when crop watering occurs at the same time as or shortly after precipitation. To prevent such issues, sophisticated IoT-based systems that use local weather forecast to provide decision assistance for irrigation must be created [62].

Temperature and soil moisture will be the focus of the study. It offers an irrigation system for agricultural regions that is fully automated. This paper contributes to the invention of a budget and efficient automated irrigation system. Once built, the system requires little maintenance and is simple to use. This research focuses on using Wi-Fi on Android mobiles to monitor agricultural fields and characteristics such as temperature and soil moisture. This technology combines live crop broadcasting via Android phones with an automatic motor on/off mechanism, making irrigation completely automated. On Wi-Fi, we may take live crop photos. The Raspberry Pi, a powerful credit card-sized microcontroller, monitors and controls the entire system. The Linux operating system runs on the Pi board [63]. Water has become one of the most significant resources and technology, and its availability are among the most significant aspects in agriculture. Irrigation controllers of various sorts have been created to automate the application of water to landscapes. Irrigation controllers that are well-known range from basic programmers to those that are based on predetermined schedules. The goal of this project was to use a PLC-based irrigation system with the aid of a soil moisture sensor to reduce water waste and boost irrigation efficiency. It also enhances the standard irrigation system, allowing it to be more efficient while using less water. The current irrigation method is inconvenient, time-consuming, and wasteful of water. The PLC-based sprinkler irrigation system outperforms the old system [64].

Agriculture is a vital source of food production in our country to meet the rising demand of the human population. Irrigation is a crucial practice in agriculture that impacts crop yield by giving water to the required acreage. To maximize water usage for agricultural crops, an efficient irrigation system is designed and developed. In the base of the tree, the system contains a dispersed wireless network of soil moisture and temperature sensors. This work presents an appealing user interface for operating the irrigation system in the most effective manner possible. It proposes the notion of monitoring the moisture content and temperature of the soil in an agricultural region, and the user may operate the watering system using an Android mobile with Wi-Fi capability. As a result, the entire implementation cost is low and reasonable for the average individual in light of the current scenario [25-30].

3. Methodology and Modeling

3.1. Introduction

We propose a system that will monitor temperature, air pressure, and humidity, as well as provide weather updates, allowing farmers to apply the appropriate amount of water at the appropriate time by turning on/off the motor. Proteus Software is being used to simulate our project. In Proteus, we put the components into schematic capture and use Visual Designer to create the flowchart. We used an Arduino Board R3 (Atmega328p) board, a DC motor shield, a DHT11 humidity and temperature sensor, a 0.96 OLED 128*624, a BMP 180, a breadboard with jumper wires, and an LED light to construct our system.

3.2. Working principle of the proposed project

Our objectives will be to manage the water supply in order to cultivate plants properly. According to prior studies, all of the lands were watered by hand. As a result, an irrigation system has been built automatically. However, none of these systems were exploiting the present and basic technology to its full potential. Some of them failed to employ real-time weather forecasts, while others failed to anticipate future weather, both of which might assist to lessen the danger of overwatering. When compared to the prior approach, when farmers were required to check the field for symptoms of dryness on a regular and ongoing basis. The irrigation will be done by sensing the weather conditions and the microcontroller deciding when the pump should be switched on/off. The framework will only use inexpensive sensors and sensibly calculated devices, as well as Adriano UNO microcontrollers, to stay below price. The irrigation will be done by measuring the weather conditions, and the microcontroller will decide when the pump should be turned on/off. The framework will only use cheap sensors and sensibly estimated devices, as well as Adriano UNO microcontroller within the budget plan, because we need to offer the device at a low cost so that every farmer can try it. Water wastage will be minimized to a minimum by employing the following automatic irrigation system since the water supply will always be analyzed and controlled by the temperature need. This gadget will also help you save money on power. As we previously stated, the system will function by identifying climate, pressure, and humidity, therefore increasing farm output rates by ensuring the proper use of agricultural resources. Farmers will save a lot of time and get a lot of relaxation since they won't have to walk to the pump to switch it on or off physically. This system would be incredibly user-friendly as well as cost-effective.

3.2.1. **Process of Work**

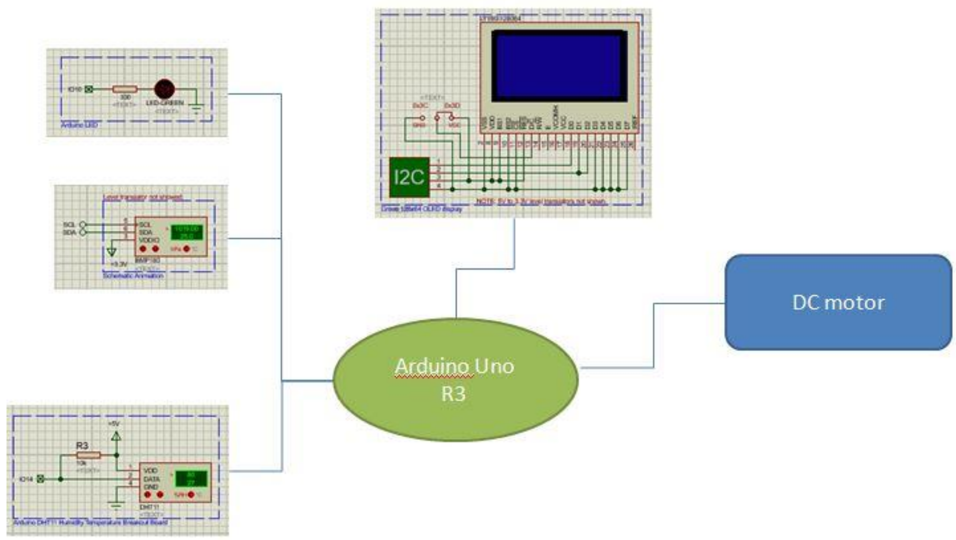

Figure1: Block Diagram

3.3. **Description of the important component**

DHT11 temperature sensor	Used for sensing temperature and humidity.
BMP(Barometric Pressure)180	Used for measure atmospheric pressure
PWM	Used for controlling speed in DC motor shield and pulse width Modulation.
H-Bridge	used for controlling rotation direction of DC motor shield.
Grove - OLED Display	use for how output of temperature and weather pressure

LED light	Is a semiconductor that emits light when an electric current is passed through it

3.4. **Implementation**

For Schematic Capture Arduino Motor Shield with DC Motors, Arduino DHT11 Humidity Temperature Breakout Board, Arduino BMP180 Digital Pressure Sensor Breakout Board, Grove OLED display module, Arduino LED's Breakout Board is used. For Arduino Motor Shield with DC Motors I03, I08, I09, I011, I012, IO13 pins are used. For Arduino DHT11 Humidity Temperature Breakout Board IO7 pin is used. For Arduino LED Red I05 Yellow 105 Green Breakout Board IO6 pin is used.

For the Visual Designer Setup Function, at first Assignment Block is assigned. In the Assignment Block "Cur_Allt", "Temp ', "M_Pressure", "Humi", "Simp_Wea_diff" "St_Pressure" and "message" variables are created and 23 is assigned in the "Cur_Allt" variable. After that by expanding the LED1,2,3 "off" method is assigned which will initially turn the LED off. Then by expanding the M1, M2 "stop" function is assigned. For Loop, at first by expanding the HTS1, "readTemperature" method is assigned Then which will read the temperature value and will keep the value in the "Temp" variable. Then in the Assignment Block," Temp:" +toString(Temp)+"*C" is assigned to the "message" variable. After that "Display" method is called. Then by expanding the PS1, "readPressure" method is attributed which will read the value for the pressure and keep it to the "M_Pressure" variable. Then in the Assignment Block" M_Pressure:" +toString(M_Pressure)+"Kpa" is assigned to the "message" variable. After that again "Display" method is called. Then by expanding the HTS1, "readHumidity" method is attributed which will take the value of the humidity and keep the value to the "Humi" variable. Then in the Assignment Block Humidity: + toString(Humi)+% is assigned in the message variable. Then again the "Display" method is called.

After that an Assignment Block is assigned where 100.3*exp (Cur_Allt / (-7990))) is assigned in the St_Pressure variable and (M_Pressure/10)- St_Pressure is assigned to the Simp_Wea_diff variable. Then again the "Condition" method is called and after that "Display" method is called. Next a delay for 2 second is generated. For the condition vent block at first decision block is assigned. Then a decision block is assigned where (Simp_Wea_diff >0.25) is assigned as the condition for the decision block. If the condition of the decision block is matched, then LED1 will turn on and LED2 , LED3 will be turn off. After that in the Assignment Block" Weather= Sunny" is assigned in the "message" variable. Then "run" method is assigned by expanding the M1 where "FORWARDS" is set to the "dir" and 255 is set to the "speed". That means the motor will run in the forward direction with the speed of 255. In the same way we have set the M2 motor. If the condition (Simp_Wea_diff >0.25) is not matched, then again a block with the condition (Simp_Wea_diff >=-0.25) && (Simp_Wea_diff <=0.25) is assigned. If the condition of the decision block is matched, then LED2 will turn on and LED1, LED3 will be turn off. After that in the Assignment Block" Weather= Sunny/Cloudy" is assigned in the "message" variable. Then "run" method is assigned by expanding the M1 where "FORWARDS" is set to the "dir" and 128 is set to the “speed”. That means the motor will run in the forward direction with the speed of 128. In the same way we have set the M2 motor. If the condition (Simp_Wea_diff >=-0.25) && (Simp_Wea_diff <=0.25) is not matched, then again a decision block with condition (Simp_Wea_diff <=-0.25) is assigned. If the condition of the decision block is matched, then LED3 will turn on and LED1, LED2 will be turn off. After that in the Assignment Block” Weather= Rainy” is assigned in the “message” variable. Then “stop” method is assigned by expanding the M1. That means the motor will turn off. In the same way we have set the M2 motor. For the Display Vent Block at first by expanding the LCD1 “clearDisplay” method is assigned. Then again by expanding the LCD1 “setTextColor” method is assigned where the value is white. Then by expanding the LCD1 “setTextSize” method is assigned where the value is 1. “setCursor” method is assigned by expanding the LCD1 where the value for both the x & y is set to 2. Next by expanding the LCD1 “print” method is assigned where “message” is set to the “variable” and “display” method is assigned in the same way. Finally, a delay for 1second is generated.

3.5. **<u>Test/Experimental setup</u>**

Firstly, by adding assignment block, new variables were created then all parameters were initialized. After all the LED lights and motors were kept off. From the peripheral LCD1, PS1, HTS1, LED1, LED2, LED3, M1, M2 were implemented and expanded. From HTS1 for reading temperature we used the variable Temp. Before showing all the results full screen was cleared and text color, size was declared and by the set cursor block whether the results will be shown was determined. For showing on the display the temperature was brought through message block. By the same process humidity and pressure were shown on the display. For applying all the conditions another assignment block was implemented. For maintaining the conditions, it will go 2^{nd} page automatically. After printing all the results were holding repeatedly with 2s on display.

3.6. **<u>Cost analysis</u>**

Object Name	Price (Collect from internet)
DHT11 temperature sensor	180 taka.
BMP(Barometric Pressure)180	195taka
Grove - OLED Display	550taka
DC Motor	800 taka
PWM 395	25 taka
H-Bridge	150 taka
LED	6 Taka

Arduino Uno R3	609 Taka

4. Results and Discussion

4.1. Simulation/Numerical analysis

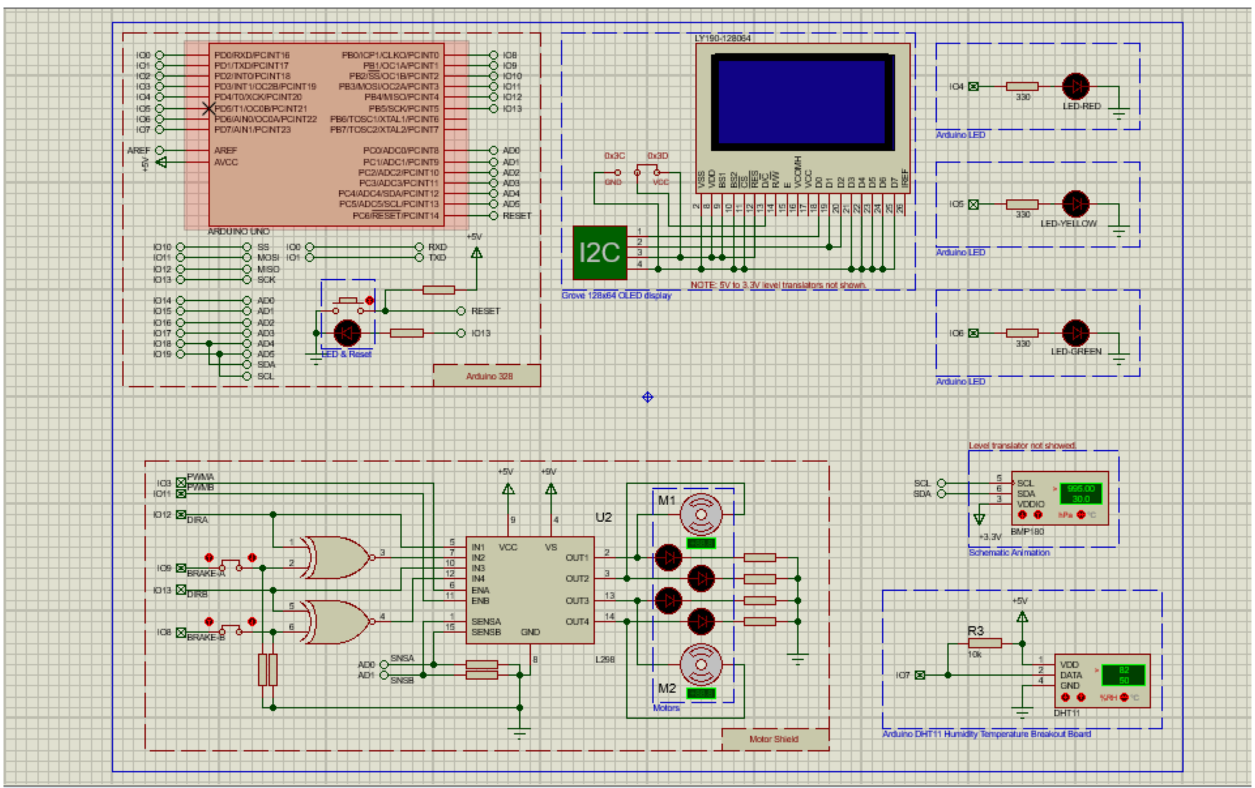

Figure2: Main Schematic Diagram

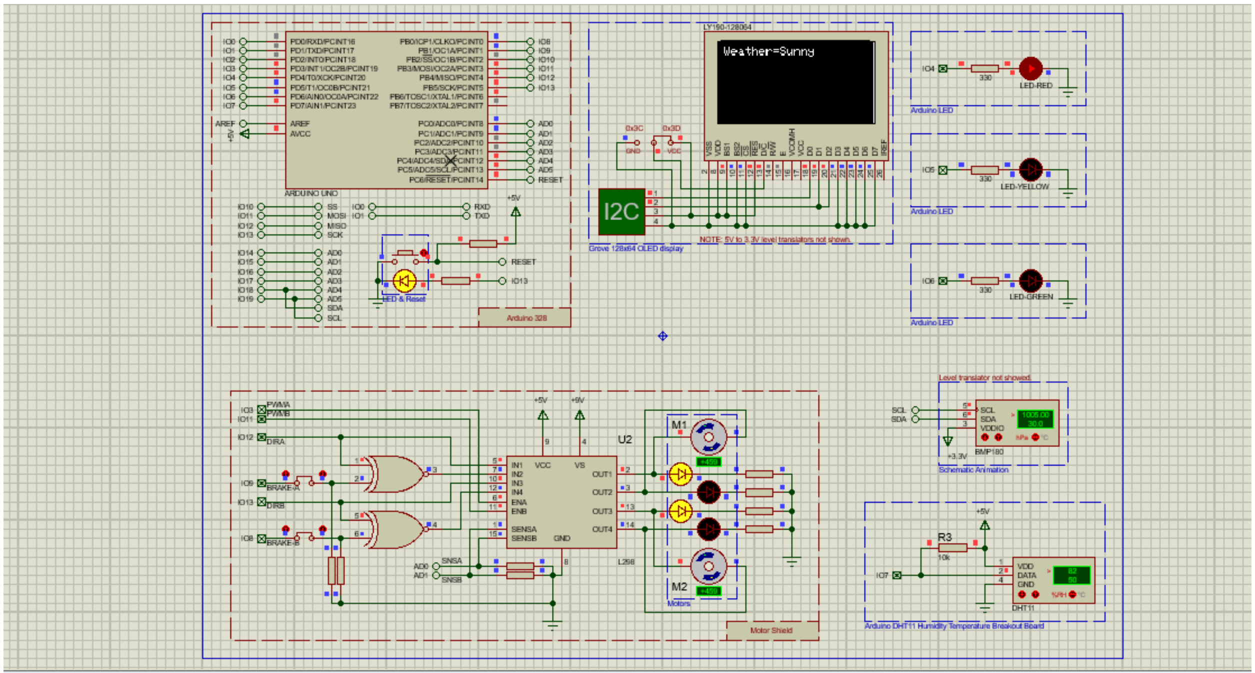

Figure3: When sunny condition occurs, Motor runs at high speed, Red LED turns on

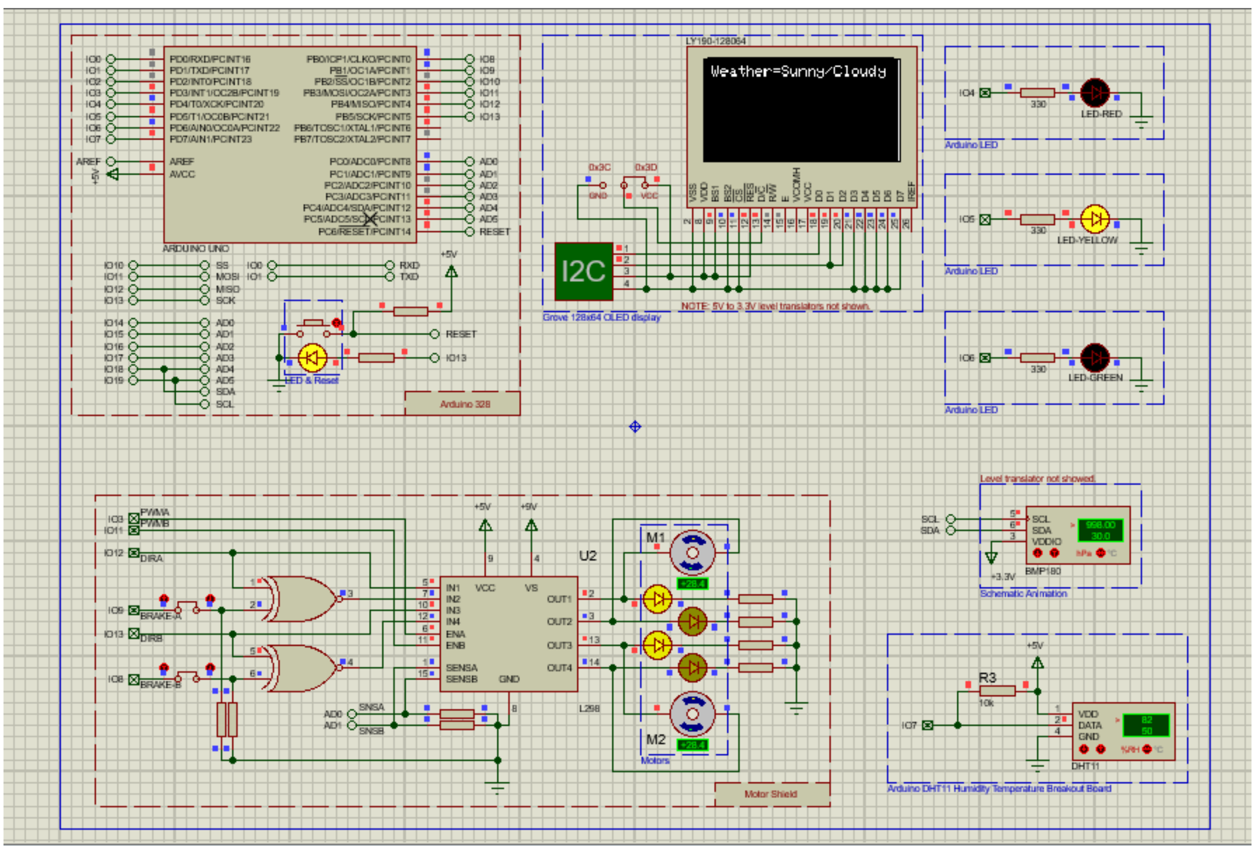

Figure4: When sunny/ rainy condition occurs, Motor runs at medium speed and Yellow LED turns on

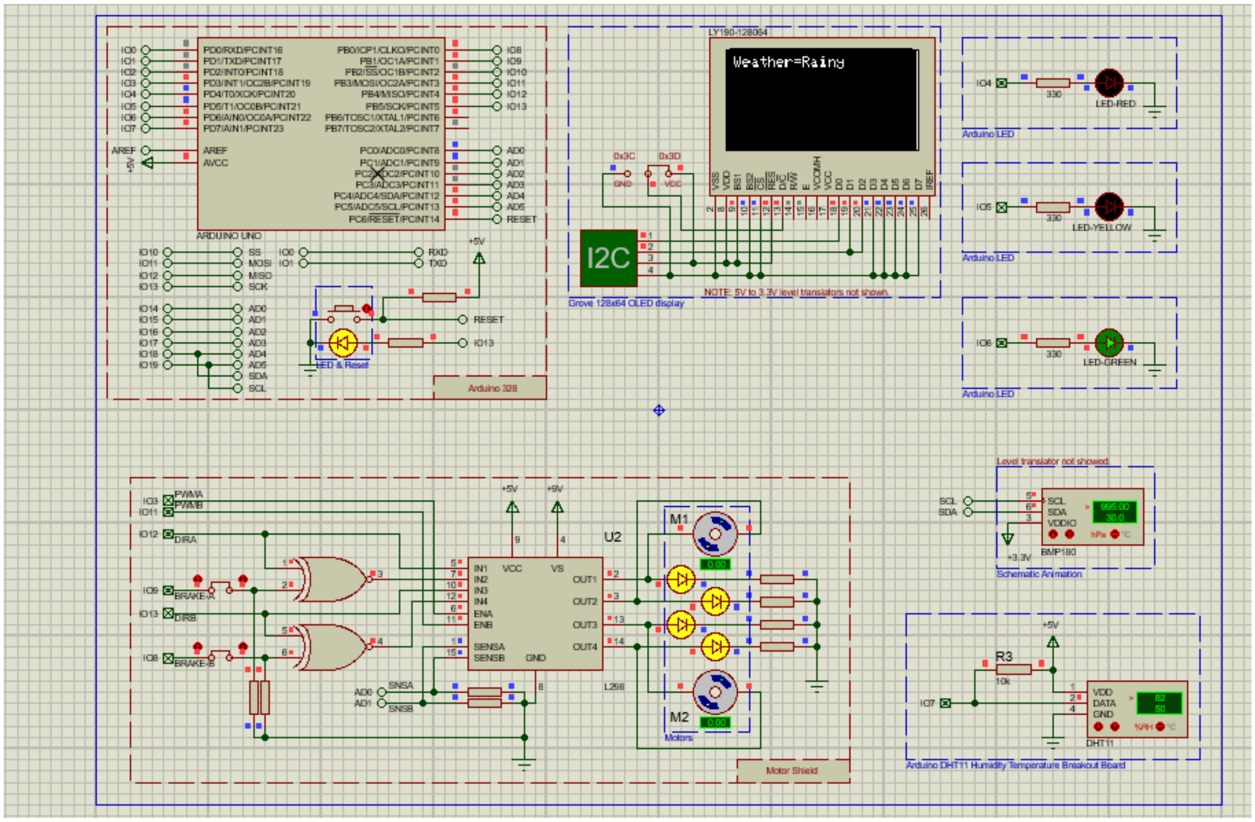

Figure5: When rainy condition occur, Motor turns off and green LED turns on.

4.2. <u>Experimental results</u>

Value	LED1(Red)	LED2(Yellow)	LED3(Green)	Pump (ON/OFF)	Pump (speed)
Value>0.25	ON	OFF	OFF	ON	255
Value>= -0.25 or Value<=0.25	OFF	ON	OFF	ON	128
Value<-0.25	OFF	OFF	ON	OFF	OFF
Value = Unknown	OFF	OFF	OFF	OFF	OFF

4.3. Comparison between numerical and experimental results

We used a DHT11 Humidity and Temperature sensor, as well as a BMP180 Digital Pressure Sensor, to measure temperature and humidity in this paper. Arduino is a single-board microcontroller that can accommodate a variety of peripherals. The major purpose of this project was to create an autonomous irrigation system for conventional farming that could identify whether the pump should be turned on or off based on weather conditions.

5. Conclusion and Limitation

5.1. Conclusion

A well designed irrigation system will result in significant increases in crop yield while reducing the amount of water wasted in existing rural irrigation systems. Manual monitoring is necessary to check the water supply in traditional farm systems. As a result, there is a human mistake of judgment that fails to account for exact meteorological stimuli and abrupt variations in soil moisture content. While this approach would provide the irrigation process more autonomy, farmers will not be able to fully benefit from the latest technology owing to a lack of information. Existing IoT solutions in rural regions are notorious for their excessive power consumption. However, our suggested solution has the potential to reduce the additional cost and increase revenue for farmers. With the assistance of our DC motor, we suggest a smart irrigation solution that uses efficient and dependable sensors to properly assess temperature, humidity, and pressure, as well as efficiently utilize water supply. Because the water supply is continually analyzed and regulated by the requirement for the soil, the following autonomous irrigation system will decrease water waste to a minimum. In the budget design, the system only requires inexpensive sensors and fairly priced gear, as well as an Arduino UNO microcontroller. Furthermore, the data can be used by other researchers for further research. Our suggested technology has the potential to eliminate the need for current irrigation systems. It's past time for the concept to be implemented and evaluated to see how effective it is in the real world, and for it to be employed in healthcare and agriculture.

5.2. Limitation

Automatic irrigation systems, offer various benefits compared to conventional irrigation systems, however our solution has a few limitations. The most major disadvantage is the expense of a smart irrigation system. These systems may be somewhat cost efficient depending on the area of the land and the quality of the sensor. In our project, we used Protius software to implement the simulation. We used an Arduino Uno R3 in this simulation and were able to connect all of the components, including the DHT11 temperature sensor, BMP (Barometric Pressure)180, and DC motor, but not the soil moisture sensor.

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Appendix (if any)