**Developing an automated process for**

**proper irrigation in the agricultural fields**

**Microprocessor and Embedded System**

1. **Introduction**

Agriculture is the backbone of the country and is synonymous to the food security of the country. Attaining food self-sufficiency by 2013 along with ensuring food to all is adopted in the ‘Vision 2021’ of the Government of Bangladesh. Pressure for increased crop production is triggered by the rapid population growth and it is the most important challenge. A part from food security, the sector alone contributes about 12 percent of the GDP and employ 44 percent workforce of the country. For these reasons, the government has put topmost priority to the agriculture sector. Agriculture sector is directly related to the rural poverty as the sector benefits livelihood of the rural poor people who account for majority of the population.

Agriculture sector is the contributor of income and employment generation in Bangladesh. Most of the farmers are marginally occupying subsistence farming. Crop production raises rural income and creates jobs for poor people. Bangladesh is one of the most climate vulnerable countries in the world. Located between the Himalayas and the Bay of Bengal, the country is very prone to natural disasters. Climate change accelerated the intensity and frequency of occurrences of salinity, storms, drought, irregular rainfall, high temperature, flash floods, etc. that resulted from global warming. Global warming is harmful for crops of the tropical countries. So Weather forecasting is one of the major problems in Bangladesh which is used to affect the quality of life and the activity of mankind. It is very difficult to collect the past information and present information about the weather condition how it known looks today. So that we need to calculate the present values in the weather condition. It may helpful for the Bangladeshi farmers to irrigate their already grown crop before it becomes damage.

Generally, the current irrigation systems are manually operated. The sensor based irrigation system is based on humidity sensor will measure the amount of water vapor present in the air which changes the current flow through the soil and then the temperature sensor is used to record the value of temperature in the land field. These two sensors are showing the value in Grove 128\*64 OLED display.

Agriculture has seen steady growth over the years, mainly due to climate change. However, greater growth may be possible if measures are taken. Therefore, efficient use of irrigation water, effective use of irrigation facilities is required to make agriculture effective in Bangladesh. Our system allows farmers to use less water to grow the same amount of crops which also reduces energy. Because it requires less energy for the dc motor. When automated, farmers are also able to easily and safely irrigate crops during times of fewer power disruptions. Our system also decreases the amount of time required for providing water to a crop area due to the regulated flow of water in the irrigation operation. In Bangladesh, which is a low-level country, most of the farmers are poor. Using our system will help small farmers improve their livelihoods by saving resources like water, power. Our system also promotes environmental sustainability. The use of efficient irrigation technology therefore helps farmers in vulnerable regions to adapt and strengthen their resilience to climate change.

Agriculture is a means of food security. With the increasing demand of food day by day, it is important that we keep the balance to produce the right amount of crops. Though in our country agriculture plays an important role we are not able to make full use of agricultural resources. The main reasons are climate change, wastage of water, scarcity of land reservoir water. Chief Engineer of Bangladesh Agricultural Development Corporation, Lutfor Rahman, said for every 100 liters water, farmers use 35 percent for required irrigation and  
misuse the remaining 65 percent which means billions of liters of water are wasted every year[2]. Beside this, extraction of water at regular intervals from earth is reducing the water level as a result of which the zones of un-irrigated lands are increasing. And agriculture is the most vulnerable sector as its productivity depends on climatic factors like temperature, air pressure, humidity, rainfall which are predicted to be erratic. To solve all these problems, we decided to design such a system that can predict weather properly by using DHT11 sensors and limit the wastage of water by simply turning off the motor automatically when required. By using our system farmers can conduct irrigation procedures properly by not wasting any agricultural resources.

At first the importance of agriculture in our economy has been discussed as food is one of our basic needs. So for proper irrigation, the previous data provided by Bangladesh agriculture statistics are shown. Then the details of each component are discussed briefly. Next the implementation of the project in circuit diagram has been given. Then the working  
principle and output of this project has been discussed. After that we have discussed about the impact of this project in our society and environment.

1. **Literature Review**

An automated Irrigation system which relies on closed loop control and feedback from sensors can help to closely match the water supply to the crop demand and avoid waste [1]. Sometimes excessive amount of water is continuously given to the crop or sometimes very less amount of water is given to the crop, defeating the purpose of the system. The output of the Systems based on Humidity and Temperature sensor are given to the A/D converter, which converts it into digital domain a then fed to the controller for the further process. [2]. Beside the present-day Automated Irrigation Systems make use of a network of sensor to get data from the field and weather. The farmer receives the information on his mobile phone in the form of a [3].

On the other hand, system enhanced water conservation using weather forecast which collects the data from a webpage about the rain prediction and provides sufficient amount of water for selected crop and soil combinations” [4]. But it also faced issues with getting real time data. Solar powered based Irrigation System [5] and Irrigation system based on

Humidity detector and soil moisture [6] also made great impact on the whole irrigation process.

The world's water assets are firstly evaporating. The unrivaled one answer for this issue is robotized Drip Irrigation framework. The created water system technique eliminates the requirement for workmanship for flooding water systems just as trickle water systems. Utilization of direct programming helps us to disseminate accessible water to the harvests if and provided that there is an enormous need of water to the harvest to get the most extreme benefit with the least expense [13]. Water deficiency deteriorates plants growth before visible wilting occurs, sometimes consumes more water and the water supply to the land is delayed due to which the crops dry out. This problem can be perfectly rectified if we use Automated Irrigation System in which the irrigation will take place only when there will be intense requirement of water, as suggested by the moisture in the soil [17]. The system continuously monitors the water level in the tank and provide accurate amount of water required to the plant or tree (crop). The system checks the temperature, and humidity of soil to retain the nutrient composition of the soil managed for proper growth of plant. The sensor sends a message from the field to the person approximately the extent of water within the area if it will increase or decreases then the operator controls the pump to regulate or flip off the telephone [18]. On the other hand, computerized Sunlight based water system control framework was used to preserve water are utilizing PLCs & SCADs for the water systems in shrewd urban areas, & the framework is likewise utilizing the IoT to keep up with correspondence between the water systems land and rancher. The GSM framework shows SMS & keeps an association between the homestead unit & the rancher's cell is provided to the phone through GSM. Temperature sensors and soil sensors are utilized to offer the exact benefit of dampness, given which the valve in the framework is turned on/off. [21].

There is a new technique in solar energy. The concept has been demonstrated. It’s generated energy from PV panels for the irrigation process. The Solar powered smart irrigation technique is the future for the farmers and a solution for energy crisis. The solar powered system is using Sine PWM technique has been used for inverter operation for minimum harmonics as given in this paper which further increases the efficiency of the system [11]. Although, this technique uses renewable energy but it had some drawbacks such as its initial cost were too high and it used a lot of space. In a new technique has been established for monitoring the moisture level of soil based on wireless sensor network. That’s presented the architecture of the project and implemented decisions through real-time data. It had also some drawbacks such as high maintenance costs and difficult installation [23]. There is an improved automated irrigation system that based on GSM based prototype for the automatic irrigation system. The main benefit of this technique is that it gave an overview of data and timetable of the irrigation process. A low initial cost the programmable logic controller (PLC) irrigation system was developed by the authors to improve the economic level of the market. That also provided a system that works on the principle of the Internet of Things and Artificial Intelligence based Irrigation system [20].

A Remote Measurement and Control System for Greenhouse Based on GSM-SMS introduced a GSM-SMS remote measurement and control system for greenhouse. Information is sent via SMS on the GSM network between the far end and the intended system. [10]. Paper portrays a utilization of a remote sensor network for minimal expense remote controlled and checked water system arrangement [16]. In a remote Measurement & Control System for Greenhouse Based on GSM -SMS the proposed system introduced a GSM-SMS remote measurement & control system for greenhouse based on PC based database system connected with the station. A Bluetooth module is also interfaced with the main microcontroller chip which eliminates the SMS charges when the user is within the limited range of few meters to the designated system. In IOT alarm system based on SIM900A, through the system setting, the alarm Message can be sent to the User-specified Mobile phone automatically no matter what the user's location are [22].

Torsi meters and granular lattice sensors (GMS) to inundate tomatoes saved water when contrasted and average water system rehearses. Further work is needed to rehash this sort of examination and future examination ought to be done on a bigger scale to decide the effectiveness of programmed water systems over manual water systems [15]. These system brings a change to management of field resources where developed a software stack called Android is used for mobile devices that include an operating system, middleware and key applications. This application makes use of the GPRS feature of mobile phone as a solution for irrigation control system. The system supports water management decision [19]. The world's water assets are firstly evaporating. The unrivaled one answer for this issue is robotized Drip Irrigation framework. The created water system technique eliminates the requirement for workmanship for flooding water systems just as trickle water systems. Additionally, straight Programming assists us with doing appropriate administration of accessible water [13]. To rectify this issue, we will use microcontroller to our Automated Irrigation.

1. **Methodology and Modeling**
   1. Introduction

We are proposing such a system which will measure the temperature, air pressure, humidity and give necessary weather updates and allow farmers to apply the right amount of water at the right time by turning on/off the motor. We are simulating our project by using Proteus Software. In Proteus, we set the components into schematic capture and draw the flowchart in Visual designer. To build our system we use Arduino Uno R3 (Atmega328p) board, DC motor shield, DHT11 humidity & temperature sensor, 0.96 OLED 128\*624, BMP 180, Breadboard and jumper wires, LED light.

* 1. Working principle of the proposed project
     1. Process of Work  [**Part under OBE assessment]**
  2. 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 |
| Soil Moisture Sensor: | grace to the changes in electrical conductivity of the soil. |

* 1. Implementation
  2. Test/Experimental setup  [**Part under OBE assessment]**
  3. Cost analysis

**[Guideline for section 3.2.1:** The ascertained project is a complex engineering problem and certainly it follows a specific method or working procedure to ensure intended functionality. Hence, one should discuss how the process is developed and the proposed “Process” is irrespective of users’ cultural (religion, language, morals etc.) and societal factors (education level, income, gender etc.).**]**

**[Guideline for section 3.5:** The design process of the experiment and the investigation behind the finalized setup should be reported here. The conception of the “Experiment” includes both the setup and study to justify the desired functionality of the developed prototype. Hence, before presenting the experimental setup and procedure, one should present which kind of engineering knowledge is required to develop such setup along with the analysis that is conducted to reach the final stage of the setup. It should be highlighted that the developed setup is a technically complicated one that requires many components to build; else, it is a big challenge to design such setup and the ultimate setup is accomplished tackling several sub-challenges.**]**

1. **Results and Discussion**
   1. Simulation/Numerical analysis
   2. Measured response/Experimental results
   3. Comparison between numerical and experimental results

[NB: Due to the pandemic, the current mode of education is completely online based; therefore, the project functionality will be demonstrated based on simulation results only. **Hence, section 4.2 can be ignored and in section 4.3, a brief discussion on the simulation results should be presented instead of comparative analysis. Since the experimental results will not be presented, so a substantial amount of simulation results and analysis should be reported in this chapter.**]

1. **Conclusion and Limitation**

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