Design, Development and Implementation of anIntelligent Soil Analyzer

[1]Khadija Akter, [1]Abu Hena Md. Mustafa Kamal,[1]Mohammad Ali and [1]Runa Rukshana Khan

[1]Department of Electronics and Communication Engineering, Institute of Science and Technology, Dhaka, Bangladesh
Corresponding author email: mmkiut09@gmail.com

Abstract

In country like Bangladesh the economy is mainly based on agriculture, still people are not able to make optimal, profitable and sustainable use of the land resources. The main reason is the lack of knowledge regarding the soil and the weather analysis for the growth of crops. In the country around 9 to 10 lakes soil samples have been received in laboratories and it is very difficult to test all the soil samples in time by the laboratories. By the time test reports are generated, harvesting is on the verge of completion. Hence there is a need for soil analysis tool kit made available to the farmer. Now climate change is a big threat to the agriculture.Changes in the intensity of rainfall events, and the break cycles of the monsoon, combined with an increased risk of critical temperatures being exceeded more frequently, could significantly change crop yields. Soil erosion greatly reduces Soil fertility. Causes of increase sea level impact the soil salinity and float. Farmers cannot get there expected result for depending on season. The main objective is to develop an analyzer or testing system which can be used for soil and weather analysis, which in term helps the farmers to cultivate and produce the proper crop.

Keywords: Climate change, Critical situation on agriculture, Digital Bangladesh, Soil Analyzer, AgriBoats.

1. INTRODUCTION

Digital Bangladesh is one of the nation's dreams. The concept of this project came from that. Soil analyzer and the AgriBoats are the emerging concept of digital Bangladesh as well as the agricultural fields. Bangladesh is a large populated country and most of these are farmers. The farmers will get the touch of agricultural science and the economic growth that come from agriculture. Soil analyzer device is an electronic device, which can be used to measure the temperature, humidity, moisture & pH (Potenzy hydrogen) values to ensure the condition of soil & weather in the field of agriculture with the select the suitable crop and also the type of fertilizer can be known. The Micro-controller is used to compare the pre-stored value with the actual values and the measured values are displayed on the LCD(Liquid Crystal Display). AgriBoats icon is a software version of the analyzer device which takes the value of analyzer device and provides crop information. This software very informative for farmer. Most of the crops information like cultivating time, process of cultivation, suitable fertilizer etc are provided by the AgriBoats Icon.

2. PROBLEM STATEMENT

Climate change impacts on Bangladesh are not a future issue. The country is affected by salinity, flood and flash floods, droughts, temperature variations, erratic rainfall etc which result in crop losses. Despite the country has shown resilience to climate change. The target of rice production was

increased and being subsequently achieved in the recent years. Price subsidy for fertilizer and other agricultural inputs has contributed to make them affordable to the farmers [1].

Rainfall is one of the major climatic factors for crop production. All crops have critical stages when it needs water for their growth and development. Moreover, excessive rainfall may occur flooding and water logging condition that also lead to crop loss. It was found that 1mm increase in rainfall at vegetative, reproductive and ripening stages decreased Aman rice production by 0.036, 0.230 and 0.292 ton respectively. Scarcity of water limits crop production while irrigation coverage is only 56% as delivered by the Bangladesh Agriculture Development Corporation (BADC) [1].

Drought mostly affects Bangladesh in pres-monsoon and post-monsoon periods. During the last 50 years, Bangladesh suffered about 20 drought conditions. The drought condition in north-western Bangladesh in recent decades had led to a shortfall of rice production of 3.5 million tons in the 1990s. If other losses, such as, to other crops (all Rabi crops, Sugarcane, Tobacco, Wheat etc.) as well as to perennial agricultural resources, such as, bamboo, betel nut, fruits like Litchi, Mango, Jack-fruit, Banana etc are considered, the loss will be substantially much higher [2].

3. OBJECTIVE OF THE RESEARCH

Agriculture is the backbone and synonymous to the food security of Bangladesh. Attaining food self-sufficiency by 2013 along with ensuring food to all is adopted in the 'Vision 2021' of the Government of Bangladesh [3]. Bangladesh located between the Himalayas and the Bay of Bengal, however this country is very prone to natural disasters [4]. 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 [5]. Incidences of floods, droughts, high temperature, flash floods and floods, etc., are predicted to be more frequent and intense. Salinity intuition could be more acute problem in future due to sea level rise [6-10].

The aim of this project is to develop a soil as well as climate analyzer device and an AgriBoats software icon that will be the replacement of an agriculture officer who guide farmer to use this technology.

4. SYSTEM DESIGN

As explained in the introduction the realization of complete of the display and the sensing devices is the major issue that the following project deals with. Following Block Diagram contain the main circuitry elements of the project.

4.1Software system flowchart

This flowchart shows that when user input the sensor data then crop selection section analyzed data logically and shows output .Informational icon represent all of information sequentially then at last communication section communicate in different sector like Agriculture office, Seed Dillard , Ministry office etc.

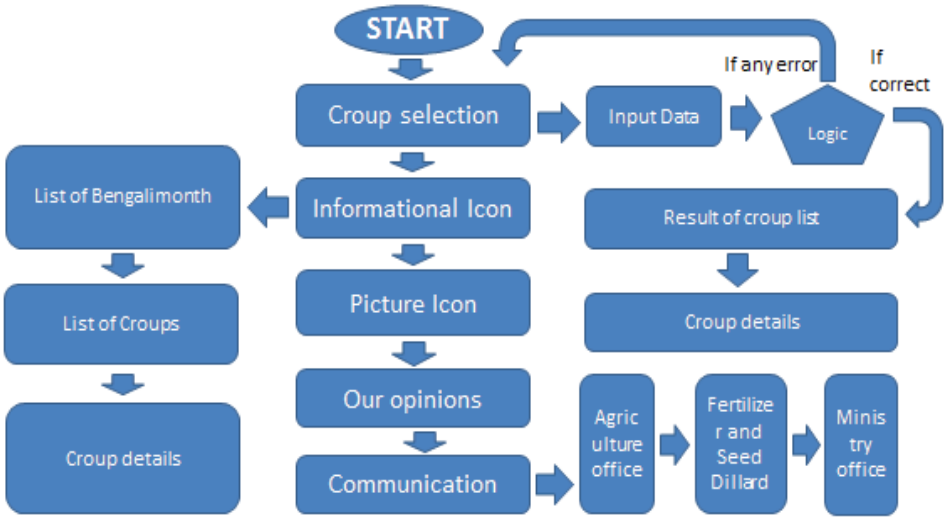

Figure 1. Software system flowchart

4.2 Hardware Design

It can classify in four groups. These are:

i.Power section: Here use 12v &1.3AH Non Spill Able Sealed Rechargeable Battery as main power source.

ii.Input Section: Sensing sectioncontains Temperature & Humidity Sensor, Soil moisture sensor & PH sensor.

iii. Processing section: In this section use Arduino Due as processing section. It collects the information from the sensors and analyzes the information.

iv. Output section: Here use za 12864 graphical display as output section.

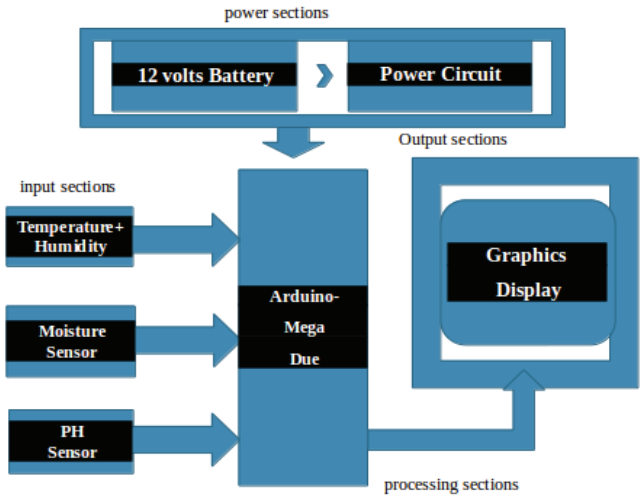

Figure 2. Hardware system Design

4.3 Analyzer Device

In this flowing figure, there are three interfacing circuits Arduino due micro-controller, sensor devices and LCD display. It is not a hidden fact that interfacing with a normal PC is quite easy with sensors

(temp+humidity, moisture, PH sensor) to send information to the Arduino board. But we must take into the fact that the devices require wired connection.

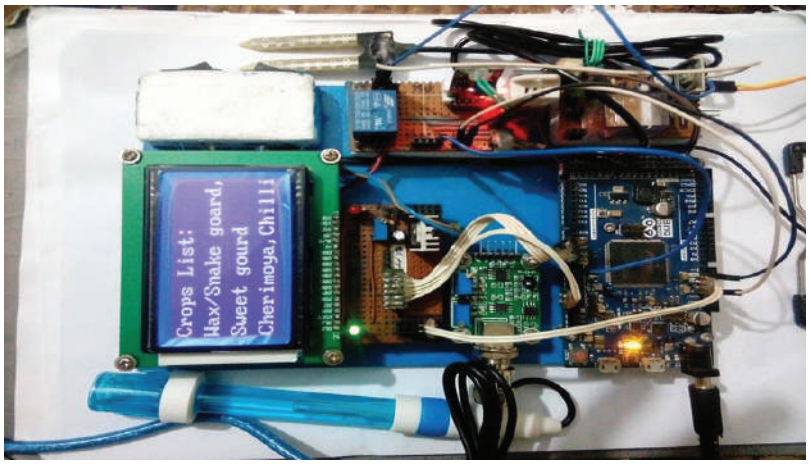

Figure 3. Implemented Analyzer device

4.4 AgriBoats icon

AgriBoats icon is a software icon where can find the information more detail and sequentially. It has two section.

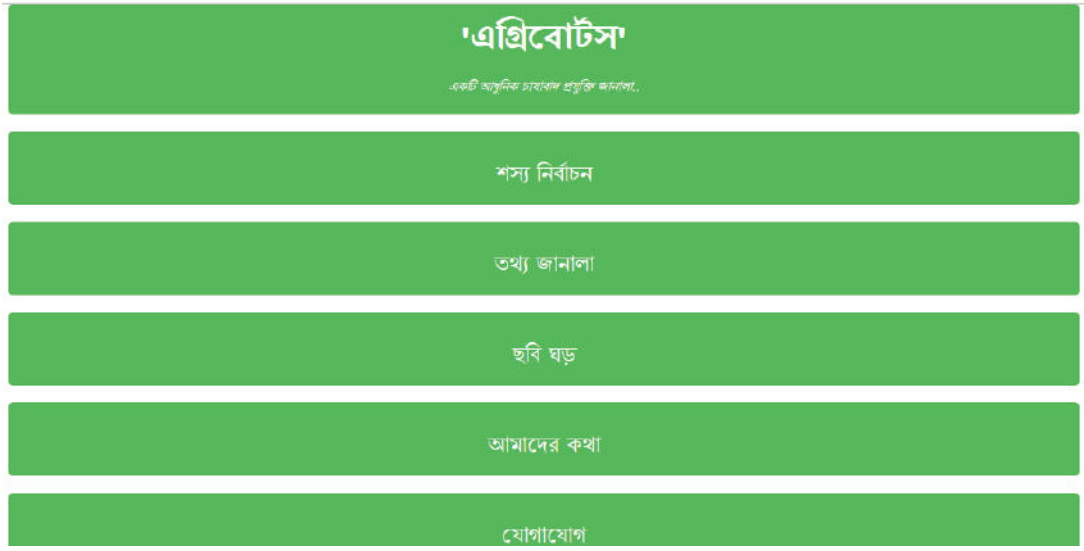

Figure 4. Overview of Agriboats Software

Selector Icon: This is a type of logical icon. Here put the value in input section. Then press the submit button to find the croup details

Suggest Icon: This is type of informational icon. Here can find all types of data around the year sequentially step by step. To find our desired crops pattern for the appropriate season.

6. SPECIFICATION AND TEST RESULT

In this project various soil test taken from different places. The test results were taken using soil analyzer device and AgriBoats icon software. The experimental results of the system are shown in the tables below:

Table 1
Experimental result in April

Date	24-4-17	28-4-17	30-4-17
Temperature	24°C	31°C	29°C
Humidity	83%	84%	87%
Moisture	99.40	95.70	88.50
pH			
Crops list	Green gram, Palwal, Teasle gourd, Sponse gourd, Ribbed Gourd, Mango, Bitnul, Berry, Lychee.	Same	same

Table 2
Experimental result in June

Date	25-6-17	28-6-17	30-6-17
Temperature	29°C	30°C	30°C
Humidity	78%	77%	80.58
Moisture	85.74	89.70	90.05
pH			
Crops list	Green gram, Palwal, Teasle gourd, Sponse gourd, Ribbed Gourd, Mango, Bitnul, Berry, Lychee.	Same	Same

Table 3
Experimental result in September

Date	2-9-17	3-9-17	4-9-17
Temperature	29°C	28°C	33°C
Humidity	85%	84%	87%
Moisture	147.98	150.45	160.74
pH			
Crops list	Ause, BRRI (51,52), BENA, BEU Rice, BRRI (33,39), Tannia, Orka, Brinjal, Pineapple, Golden apple, Guava, Star Fruit, Pomelo.	Same	same

7. CONCLUSION

Achieving digital agriculture realize a smart farming which will help all of production, distribution, consumption, farm society and village to grow as the world's trend changes with new developing technologies. The values of soil analyzer and AgriBoats are measured in real time and compared with the pre-stored values received from the agricultural department. The system also provides the information about the crops that can be grown in respective soils. The tools like crop detection system and informational system can possibly reduce the cost to achieve ecological and economically sustainable agriculture. As the level of environment of all of these factors gets higher, during the entire process of agricultural production, distribution, and consumption, productivity, efficiency, and Quality of agriculture business would get higher added value industry.

REFERENCES

[1] Planning Commission. (2009). Millennium Development Goals – Need Assessment and Costing 2009-2015 Bangladesh. General Economics Division, Planning Commission, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

[2] Ministry of Environment and Forest (MoEF). (2009). Bangladesh Climate Change Strategy Action Plan, 2009, Government of the People Republic of Bangladesh.

[3] World Bank. (2010). Bangladesh – Country Assessment Strategy FY 2011 – 2014. Bangladesh Country Management Unit, South Asia Region, The World Bank Office, Dhaka.

[4] UNEP. (2009). IEA Training Manual, Volume Two, Vulnerability and Impact Assessments for Adaptation to Climate Change (VIA Module).

[5] World Bank. (2000). Bangladesh: Climate Change & Sustainable Development. Report No. 21104 Bangladesh, Dhaka.

[6] IEEExplore White Paper (June 2011)."The application of Proteus in teaching of microcomputer principles".

[7] IEEExplore White Paper (April 2010)."Application of Proteus virtual system modelling in teaching of microcontroller".

[8] Modeling of seasonal water balance for crop production in Bangladesh with implications for future projection _ Karim _ Italian Journal of Agronomy.

[9] Planning Commission. (2010). Outline Perspective Plan of Bangladesh 2010-2021- Making Vision 2021 A Reality, Final Draft. General Economics Division, Planning Commission, Government of the People's Republic of Bangladesh, Dhaka, Bangladesh.

[10] [Online] Available: http://www.irdindia.in/journal_itsi/pdf/vol1_iss5/22.pdf