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INTRODUCTION

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1.1. INTRODUCTION OF THE STUDY

The significance and role of tea industry in the development of Assam and its inhabitants is undeniable. Among all the activities happening in tea gardens, the most significant task is watering of tea plants, demanding huge electric power, man power and natural resources. Among all necessary requirements, the most important requirement for healthy tea gardening system is the presence of soil moisture in proper and accurate level. Presence of soil moisture in tea plants in high or low levels will influence on the desired production output of the garden. Hence an intelligent system that monitors the task of watering will be a modernization leap in tea industry. Therefore, to achieve this we need to understand in detail about the link between tea plants and the method of watering being used. In this case any control on soil moisture level which tea plants depends on for their nutrition will pave a way for maximizing tea production. For obtaining this goal, the smart data acquisition system will be operating on a precise parameter i.e. soil moisture control; which has significant affect on health, growth and productivity of tea plants.

Among the soil properties, moisture holding capacity has fundamental and even a direct relation to tea plant's growth, tea estate production and plant health; hence true potential of being a parameter for soil moisture monitoring system. For real time implementation of smart monitoring system, the selected parameter has reliable, accurate and flexible qualities which can be used for sensing the parameter from soil properties in real time.

The selected parameter has abundant advancement options available, if it becomes necessary for increasing the efficiency of proposed system. For instance GSM based notification system [1, 2] and Web based database management and monitoring program. Another requirement may be storing soil moisture data in periodic interval for future analysis.

1.2 TEA GARDENS OF ASSAM AND INFLUENCE OF CLIMATE ON TEA PALNTS

Assam is world famous for its quality of tea as well as the natural beauty of the tea plantation area. Assam is the world's largest tea growing region, producing more than 400 million of kgs. of tea annually. Beautiful tea estates of Assam cover about 2,16,200 hectares of land [4]. Assam today comprises of more than 100 tea estates. Cropping season normally begins from March and lasts by mid December. The first plucking starts in March and continues for around two months. The second plucking season starts from June. Nowhere in the world does the tea grow in such a large quantity as in Assam.

Tea drinking first originated in China [5]. It was in 1823 the first tea plants were discovered in Assam by Major Robert Bruce [6]. He discovered the existence to Tea in Assam.

The leaves of these plants were sent to the botanical gardens, which were later on classified as to be of the same species as the china tea plant. It was in 1839, when the first company for growing and making tea was set up in India, Assam tea was set up.

In 1862, Assam Tea industry comprised of 160 gardens, which were owned by five public companies and 57 private companies [6]. Later on the government appointed a special commission to enquire about all the aspects of the company. From then the company start growing and now it is one of the major companies generating huge amounts of revenue.

The tea crop goes through two types of stresses in its life cycle-biotic and abiotic. Events such as droughts and floods make up abiotic stress, which in turn results in creating biotic stress for the crop in the form of increased pest attacks. Due to erratic climate patterns, the stresses have become more pronounced and profuse on the crop. More biotic stress compels cultivators to use more pesticides and fertilizers while increased abiotic stress demands for

more irrigation, though tea is traditionally a rain-fed crop. This only increases the associated costs.

Currently the major tea growing states of India are Assam, West Bengal, Tripura, Tamil Nadu, Kerala and Karnataka, Himachal Pradesh and Uttaranchal, Arunachal Pradesh, Manipur, Sikkim, Nagaland, Meghalaya, Bihar, Orissa, etc. Among these states Assam is the major producer contributing about 52% of the total Indian production followed by West Bengal about 22 %, Tamil Nadu about 16%, Kerala about 8 % and others about 2%. The given pi diagram depicts the state wise tea production in India [7].
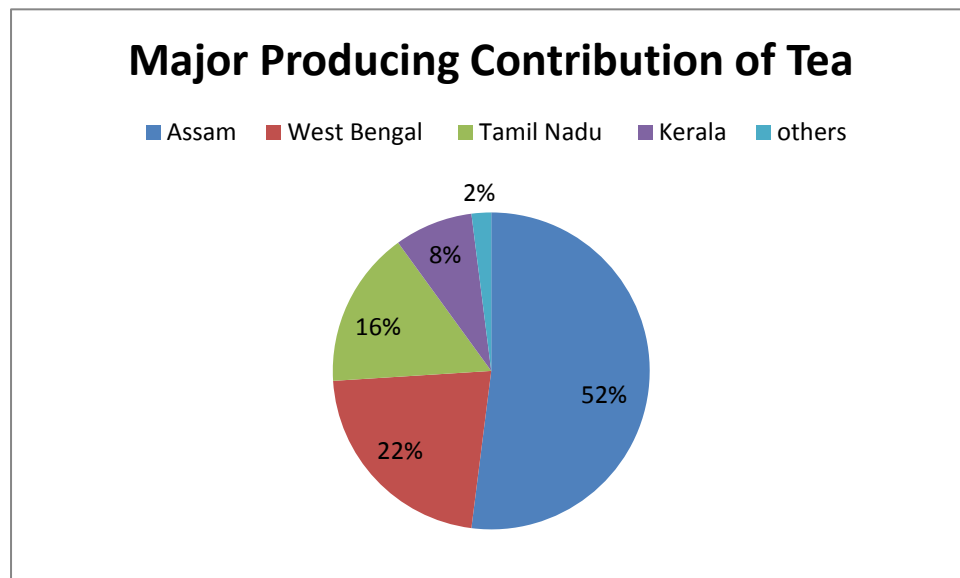

Figure 1.1: Major producing contribution of tea

1.3. FEATURES OF TEA PLANTATION

Production of tea depends mainly on the climatic conditions. The temperature may vary from 20°C to 32°C and annual rainfall should be 1250 to 1500 mm, which is well distributed over 8 to 9 months in a year. The atmospheric humidity should be always around 70% to 80% during most of the time. Very dry atmosphere is not suitable for tea.

There are some important physical parameters of soil to improve the plant growth and productivity of tea yielded. These are soil temperature, soil moisture, bulk density.

The average annual rainfall in North East India ranges from 2000-4000 mm. However, more than the total amount, the distribution of rainfall matters a lot for sustained high yield of tea throughout the season. In the North East India, the rainfall distribution is not even. Excess rainfall in the monsoon month of June- September causes drainage problems. The average monthly rainfall during November to march is less than the evapotranspiration loss and the resulting soil moisture deficit affect tea bushes [8].

Tea grows best within a pH range 4.5 to 5.5. The pH value of a soil is exceed of 6 is not suitable for tea [9]. Soil samples should be analyzed regularly for assessment of acidity status so that necessary corrections can be carried out.

1.4. ORIGIN OF RESEARCH PROBLEM

Due to rising problems of climatic turbulence, changing water requirement of plants; poor maintenance of agricultural soil and tea plants in the past, the health of tea industry is at risk. The evidence of such destructive change can be apparently judged by gradual decline of productivity and quality of tea leafs. Therefore, the present scenario demands for an intelligent system that can monitor and provide accurate information regarding water requirement for individual tea plant, i.e. there is need of control of watering in plants which will be efficient in terms of cost, water and electric power. However, in practice, it seems to be quite impossible to care for each nook and corner of the vast wide spread tea garden by human workforce. Hence, a network of wireless communication will help in solving this problem in vast tea gardens. In addition to it when software based platform for database development of garden soil condition will be interfaced with the system. It will facilitate long run decision making process by statistical analysis of the database information.

Tea gardens are spread over very vast area; this makes the task of monitoring and caring for plants a challenging one. Therefore the mandatory task of watering tea plants demands large amount of water, electric power and man power. Moreover, water requirement of soil for different areas in tea garden are different. The inaccurate information about amount of water required for different plots results in insufficient and excess distribution of water in different plots; which in both cases is harmful for plants. It is evidently wastage of water and electrical power in tea gardens, happening in areas as vast as tea gardens, results in huge wastage of natural resources and energy. Moreover, till date, there has been no tool developed that monitors the health of garden soil; no attention has been paid in soil condition of tea garden which directly affect the quality and productivity of tea estate. Therefore, an intelligent platform with facilities for statistical analysis of soil condition in the past; will positively drive the decision making process, in long term planning, in favor of the tea industries.

And so, through this present study, an attempt is made to design and develop a smart data acquisition system so that we can monitor the level of soil moisture online; we can record the online data for further study and analysis, and even we can monitor the soil moisture online too.

1.5. OBJECTIVES OF THE RESEARCH WORK

1. Development of software platform for operation on collected data for maintaining soil moisture through Radio Frequency (RF) wireless network.
2. Minimisation of water wastage in watering process; reduction in labour and management cost.
3. Analysis of the production yield of tea.
4. Database development through wireless data acquisition from sensors for statistical analysis of soil moisture.

5. Ease of accessibility to monitor and control water moisture level of soil even out of field using GSM service.

1.6. HYPOTHESIS

a) **Working Hypothesis**: Data Acquisition System (Soil moisture) has influences the tea productivity in tea garden.

Null Hypothesis [H_N]:

Data Acquisition System (Soil moisture) doesn't have any significance in Tea productivity in tea Garden.

Alternate Hypothesis [H_A]:

Data Acquisition System (Soil moisture) has significance in Tea productivity in tea Garden.

b) **Working Hypothesis**: Data Acquisition System (Soil moisture) has influences on minimisation of water wastage in watering process in tea garden.

Null Hypothesis [H_N]:

Data Acquisition System (Soil moisture) doesn't have any significance in minimisation of water wastage in watering process.

Alternate Hypothesis [H_A]:

Data Acquisition System (Soil moisture) has significance in minimisation of water wastage in watering process.

1.7. ORGANIZATION OF THE THESIS

Chapter 1: INTRODUCTION

This first chapter provides an introduction to the topic of research. The Chapter contains Objectives, problem definition, hypothesis etc.

Chapter 2: REVIEW OF LITERATURE

A comprehensive review of some relevant literature is presented in this chapter i.e. the review of research paper, books and research article etc.

Chapter 3: RESEARCH METHODOLOGY AND SYSTEM DESIGN

This chapter provides the methods of approaching the goal and objective of the thesis. This chapter contains method to achieve the objective of the research and the algorithm and system module and its organization of the system.

Chapter 4: ANALYSIS OF ROUTING PROTOCOL

In this chapter, the analysis of different routing protocols which are used in wireless transmission are discussed check their energy consumption and packet delivery ratio.

Chapter 5: RESULT AND DISCUSSION

This chapter provides the summary of the outputs of the system and its discussion.

Chapter 6: CONCLUSION AND FUTURE SCOPE

The details in this chapter provide a summary of Conclusions based on the study.