Synopsis
On
"Markov chain model of Rainfall Probability for agricultural Planning in Anand"

INNOVATION INFORMATION TRANSFORMATION

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1. Title

Markov chain model of Rainfall Probability for agricultural Planning in Anand

2. Introduction

The yield of crop particularly under rain fed condition depends on the rainfall pattern. Simple criteria related to sequential phenomena like dry and wet spells could be used for analyzing rainfall data to obtain specific information recognized as a suitable model to explain the long term frequency behavior of wet or dry spells. Several authors have demonstrated its practical utility in agricultural planning for both long and short term periods. This model enables to determine the probability of occurrence of dry and wet spells during a particular week.

3. Scope

Web Based Markov Model for wet and dry analysis, tools is the web based system using which Scientist can generate graphs and reports based on the weather data by the observatory for various purpose of their research or Agricultural Planning.

4. Objectives

- To create DBMS for Rainfall data of Agro meteorological observatory of Anand.
- To develop tool for Markov Model for wet and dry analysis, Descriptive data analysis and Rainfall data Normal.
- To harness Information Technology to achieve the above objectives.

5. Methodology:

- **Markov chain Model :**

Markov chain is a probabilistic automaton. The probability distribution of state transitions is typically represented as the Markov chain's transition matrix. If the Markov chain has N possible states, the matrix will be an N x N matrix, such that entry (I, J) is the probability of transitioning from state I to state J. Additionally, the transition matrix must be a stochastic matrix, a matrix whose entries in each row must add up to exactly 1. This makes complete sense, since each row represents its own probability distribution.

A Wet week (or a Dry week) has been defined as one with ≥ 5 mm (≤ 5 mm) of rainfall according to definition proposed by the Indian Meteorological Department. This gives a sequence of wet and dry weeks. Further, under the assumption that the occurrence of a wet or a dry week is influenced only by the weather condition of the previous week, the process of occurrence of wet and dry weeks can be described by a 2- state Markov chain with wet and dry weeks as the two states. The transition probability matrix P, which describes the 2 – state Markov chain model is given by

$$P = \begin{bmatrix} P_{D/D} & P_{D/W} \\ P_{W/D} & P_{W/W} \end{bmatrix},$$

with PD/D+PD/W=1 and PW/D+PW/W=1, where PD/D, PD/W, PW/D and PW/W are the transition probabilities. That is, they are respectively the probabilities of the following conditional events:

ED/D: A week is a dry week given that the preceding week was a dry week.
EW/D: A week is a wet week given that the preceding week was a dry week.

ED/W: A week is a dry week given that the preceding week was a wet week. EW/W: A week is a wet week given that the preceding week was a wet week.

Suppose that each week from January to December is classified according to the occurrence of the four events ED/D, ED/W, EW/D and EW/W such that 1st week depends on the 52nd week of December. Then, repeating this process for each year, frequencies of the occurrences of events are counted. Let these observed frequencies be denoted a, b, c and d

for the respective events with a + b = n0 and c + d = n1. The maximum likelihood estimates of the unknown probabilities PD/D, PD/W, PW/D and PW/W i.e., the parameters of the model are obtained as,

$$\hat{P}_{D/D} = p_{D/D} = \frac{a}{n_0}, \qquad \hat{P}_{D/W} = p_{D/W} = \frac{b}{n_0}$$

$$\hat{P}_{W/D} = p_{W/D} = \frac{c}{n_1}, \qquad \hat{P}_{W/W} = p_{W/W} = \frac{d}{n_1}$$

The transition probabilities are conditional probabilities. But, the probability of a dry week (PD) and the probability of wet week (PW) are estimated from the observed frequencies of the conditional events as follows:

$$\hat{P}_D = p_D = \frac{a+c}{n_0+n_1} \ \ and \ \ \hat{P}_W = p_W = \frac{b+d}{n_0+n_1}$$

These unconditional probabilities are also called binomial probabilities treating a wet week as a success and a dry week as a failure.

6. Software Requirement:

- Language : Python 3
- Framework : Django
- Database : Mysql
- Text editor : Vs code
- Os : Win 7,8,10 or Linux, or Mac
- Browser : chrome Browser

7. Hardware Requirement:

- Processors: Intel Atom® processor or Intel® Core™ i3 processor
- RAM : Minimum 4GB for Windows Os
- Hard Disk : Minimum 500 GB

8. Module

1. Data Analysis module:

This is the important part of this platform where the scientist or researchers can generate different types of graphs by selecting different types of weather or climatic parameters. Here they can view graphs and data according to their selection. The registered scientist or researchers can also download the graphs in .pdf format.

2. Data Input module:

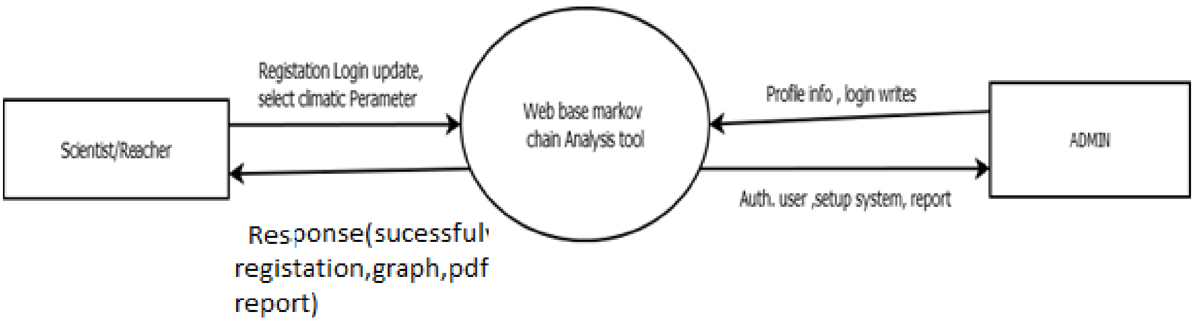
This is the important part of this platform where the registered scientist can upload the data in the standard format and after admin verify the format and then data will be inserted in the database.

3. Admin module:

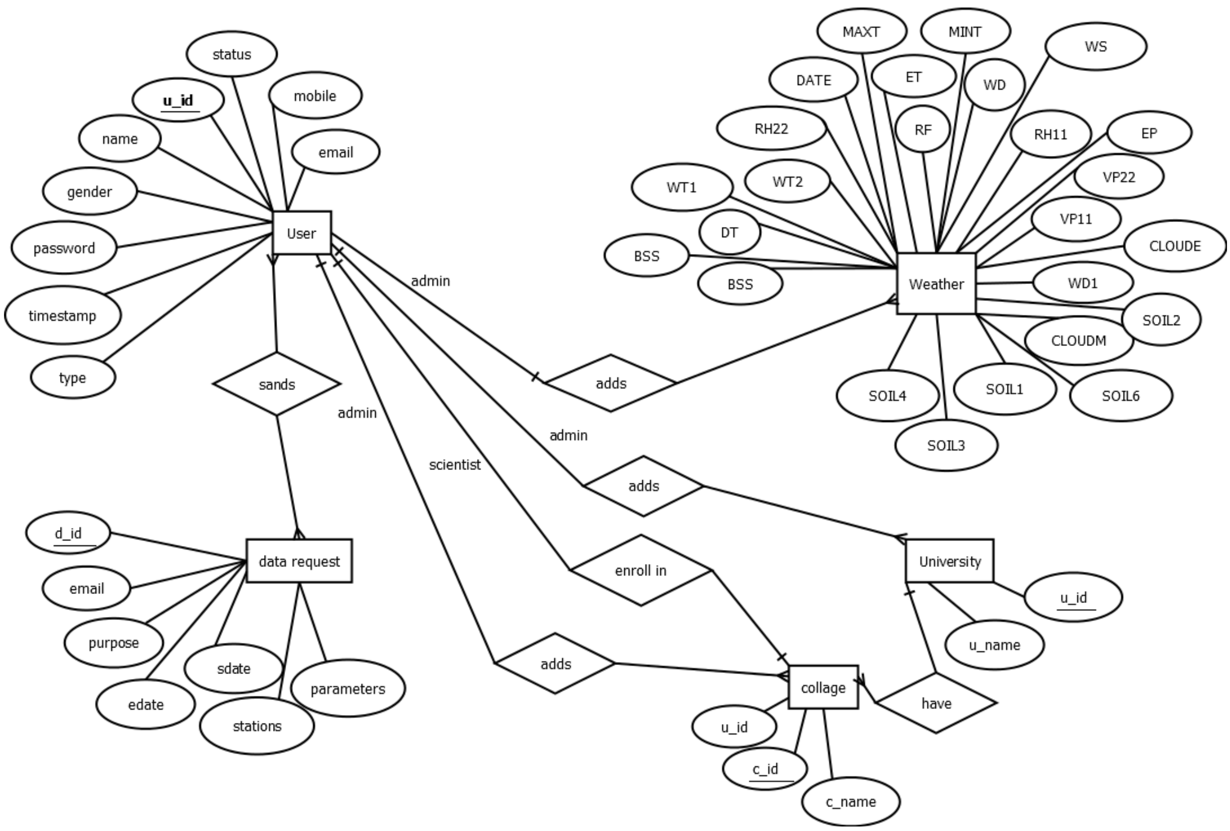
This part is basically created for the maintenance of the platform. The admin will be the final authority to take decision regarding any misuse or any complaint. The first job done using this module would be that the admin could see all the registered scientist or researchers in this web based application.

9. DFD(Data Flow Diagram)

Level 0



10. ER(Entity-Relation) Diagram



11. Data Dictionary

1) **Registration Table**

	Field	Datatype	Keys	Descript.
01	Id	Int	Primary Key	Scientist registration Id
02	name	varchar(MAX)		Scientist Name
03	gender	varchar(MAX)		Scientist gender
04	mobile	varchar(MAX)	Unique	Scientist mobile no
05	university	varchar(MAX)		Scientist university
06	department	varchar(MAX)		Scientist department
07	email	varchar(MAX)	Unique	Scientist email
08	password	varchar(MAX)		Scientist password
09	type	varchar(MAX)		Scientist type
10	status	varchar(MAX)		Scientist status
11	timeStamp	Date		Scientist timestamp
12	College	varchar(MAX)		Scientist College

2) **College Table**

Sr.no	Field	Datatype	Keys	Descript.
01	C_id	Int	Primary Key	College id
02	C_name	varchar(MAX)		College name
03	U_id	int	Foreign Key	University id

3) **University Table**

Sr.no	Field	Datatype	Keys	Descript.
01	U_id	Int	Primary Key	University id
02	U_name	Varchar		University name

4) **Data Request Table**

Sr.no	Field	Datatype	Keys	Descript.
01	D_ID	Int	Primary Key	Auto generated ID
02	Email	varchar(MAX)		Email of registered User
03	User Category	varchar(MAX)		UserCategory
04	sdate	Date		Starting Date
05	edate	Date		Ending Date
06	stations	varchar(MAX)		Station from where data collected
07	Purpose	varchar(MAX)		Purpose

08	Parameters	varchar(MAX)		Parameters Required
09	Time Stamp	DateTime		Time stamp at which User request for data

5) **Weather Table**

Sr.no	Field	Data type	Keys	Descript.
1	Date	Date		Daily Date
2	EP	Decimal(5,2)		Evaporation
3	ET	Decimal(5,2)		Evapo- transpiration
4	BSS	Decimal(5,2)		Sunshine hour
5	WS	Decimal(5,2)		Wind Speed
6	WD1	Decimal(5,2)		Wind Direction Morning
7	WD2	Decimal(5,2)		Wind Direction Afternoon
8	RH1	Decimal(5,2)		Relative Humidity Morning
9	RH2	Decimal(5,2)		Relative Humidity Afternoon
10	Mean RH	Decimal(5,2)		Mean Relative Humidity
11	MaxTemp	Decimal(5,2)		Maximum temperature
12	MinTemp	Decimal(5,2)		Minimum temperature
13	MeanTemp	Decimal(5,2)		Mean temperature
14	VP1	Decimal(5,2)		Vapour Pressure morning
15	VP2	Decimal(5,2)		Vapour Pressure afternoon
16	VPMean	Decimal(5,2)		
17	Soil(5cm)M	Decimal(5,2)		Soil temp at depth of 5 cm Morning
18	Soil(10cm)M	Decimal(5,2)		Soil temp at depth of 10 cm Morning
19	Soil(20cm)M	Decimal(5,2)		Soil temp at depth of 15 cm Morning
20	Soil(5cm)A	Decimal(5,2)		Soil temp at depth of 5 cm Afternoon
21	Soil(10cm)A	Decimal(5,2)		Soil temp at depth of 10 cm Afternoon
22	Soil(20cm)A	Decimal(5,2)		Soil temp at depth of 20 cm Afternoon
23	RD	Decimal(5,2)		Rainy Day
24	RF	Decimal(5,2)		Rain Fall
25	CC1	Decimal(5,2)		Cloud Day morning
26	CC2	Decimal(5,2)		Cloud Day afternoon

12. References

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3) International Journal of Innovative Research in Science, Engineering and Technology (An ISO 3297: 2007 Certified Organization) Vol. 4, Issue 7, July 2015 Copyright to IJIRSET DOI:10.15680/IJIRSET.2015.0407199 6644 Markov Chain Model for Probability of Weekly Rainfall in Mandya District, Karnataka
4) [http://www.ijirset.com/upload/2015/july/199_krishnamurthy%20int%20jul.pdf]