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Weather Prediction Using Indian Almanac Rules

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***Abstract*—** Panchang is a traditional Indian Almanac that has been in practice for over 5 millennia. Important meteorological predictions have been fossilised by this method. The Panchang predictions are approximated for a small area, based on astrological occurrences like effects on weather when different celestial bodies come close to one another etc. Panchang consists of 5 components, namely Tithi, Vaara, Nakshatra, Yoga and Karana, along with many different terminologies. Panchang predictions are carried out using some observed rules. Extensive study of these rules has been performed and then an attempt has been made to write a program which incorporates a set of rules and regulations. The main aim was to predict what type of rainfall will be observed on a particular day based on Planetary and Nakshatra positions. A basic implementation of two Panchang types (In python language) has been done. One being Traditional Panchang and the other- Tamil Panchangam. Both the methods mostly use similar rules and logic, but Traditional Panchang allows prediction for a shorter time period accurately and Tamil Panchangam provides accurate predictions for the yearly time period.

***Keywords*—**Panchang, Conjunctions, Nakshatras, Ecliptic Longitude, Right Ascension

I. INTRODUCTION

Weather has become a very unpredictable phenomenon, due to pollution etc. This makes its prediction (which itself is very difficult to perform) even more difficult to implement. Using multiple methods to perform weather prediction allows for better prediction quality overall. If we see the ancient manuscripts like Vedas or Upanishads, the Indian methods for weather prediction can be classified into two categories:

(i) **Theoretical methods**: This method applies astronomical or planetary factors and computes the positions of celestial bodies and their conjunction.
(ii) **Observational methods**: The observational methods deal with atmospheric changes, including the dominant cloud type and their resulting rainfall.

The Indian Almanac (Also known as Panchang/Panchangam depending on the area, we will be using the term Panchang/Panchangam instead of Indian almanac as we move ahead) is a Theoretical Method as it majorly involves Planetary motion and placement for predictions. A typical Panchang works with the locations of the heavenly bodies on a daily basis for an entire year for a given locality and time. In India, there is considerable traditional knowledge of different rainfall patterns. Estimation of rainfall using age-old techniques is a usual routine among the peasants and the time periods used by them are known as 'Nakshatras', which are 13 or 14 calendar day periods. These Nakshatras are just a cluster of stars and according to the Indian astrology, there are 27 Nakshatras present in 12 Zodiac Signs. So, for a typical Panchang to predict rainfall, various parameters such as different planetary positions in different nakshatras, to see if they are in conjunction with one another are considered. In Panchang/Panchangam, rainfall is studied from the movement of the Sun through all the zodiac constellations that accounts for a solar year.

In this project we have tried to implement these methods using some rules that were found while studying some research papers. We used two renowned Panchang, one is the Traditional Panchang, which is predominantly used in the region of Maharashtra and the other is Tamil Panchangam, used in the southern parts of India. The reason for taking up this project is due to our Internship at TechMahindra Maker's Lab, where the stakeholders want to use these implementations in their weather prediction system. Additionally, we also wanted to test how relevant are these methods in today's world. We have implemented both these systems in Python and have used PyEphem library for ephemeris calculation whenever required. We have achieved a measurable accuracy of 63.49% for the city of Pune.

Rest of the paper is organized as follows, Section I contains the introduction of Panchang., Section II contains related work done using Almanac rules, Section III contains the Methodology of our research, Section IV contains the results, Graphs, tables for our research and implementation, Section V concludes the research work with limitations and future work.

II. RELATED WORK

Meteorological predictions preserved in Panchangam versus real-time observations, a case study over Tirupati region by Vanadeep and K. Musali (2012) [1]. This paper focuses on the comprehensive study of the astronomical bodies and their effects on rainfall on the earth, when they come in conjunction with each other, according to Panchang. In this, authors have also observed different types of clouds and their origin, and how they contribute to the rainfall for a certain amount of time over a specific Tirupati region. Using these methods for rainfall prediction, writers have achieved the accuracy of 57% during the study period.

Traditional almanac predicted rainfall - A case study by S. Sivaprakasam and V. Kanakasabai (2008)[2]. This paper has proposed a method for predicting rainfall for a whole year using Tamil Panchangam. In this they considered the 60 year cycle, in which they found the King, Minister, Megathipathi and dominant Cloud type for each year in cycle, and predicted the rainfall based on these four parameters in ancient Marakkal units (which is 100 yojanas in height and 60 yojanas in width), and compared the same with the actual rainfall recorded for that certain year.

Astro-Meteorological Rainfall Prediction and Validation for Monsoon in Gujarat by V.B. Vaidya and K.S. Damle (2019)[3]. This paper has discussed majorly about the transitions of the Sun in 27 different Nakshatras, and its effect on rains, while it is present in that nakshatra. Authors have also discussed creating different Kundalis for each day, and predicting the weather based on the planet's positions on that particular day. For calculating the rainfall probability of getting rainfall more than 10mm, they have used the Markov chain model, for each district. Authors have also considered the native techniques, used for rainfall prediction, such as characteristics of flowers and fruits in the region. On combining all these methods, they achieved the overall average score of 60%.

Prediction of rainfall variation through flowering phenology of night-flowering jasmine in Tripura by Sandeep Acharya (2010)[4]. In this paper, authors have discussed, how the flower bloom percent of night-flowering jasmine in different regions of Tripura are directly proportional to the rainfall occurring in the region. Also different characteristics of jasmine were considered for the prediction of rainfall, for example, if large size buds are observed in a region, then there will be heavy rain in that region.

Contribution to weather science in Ancient India VIII-Observation and Measurement of Meteorological parameters in ancient India by A.S. Ramanathan (1985)[5]. This paper describes the weather forecasting methods suggested by Varahamihira rishi. Author discussed Wind direction and speed, Types of clouds along with their formation position, Lightning direction, different Thunder sounds and soil precipitation, to forecast the weather of a region.

III. METHODOLOGY

A. TAMIL PANCHANGAM: -

Tamil Panchangam year starts from Chaitram (April) and goes on till Phalgunam (March). The panchang being considered is Asal 28 No Manonmani Vilasa Suddha Vakiya Panchangam. It is an age-old almanac which was specially developed for the Monarch in Tamil Nadu. An ancient sage, Parashara, suggested this almanac, in which every year a particular heavenly body was selected as a ruler, another celestial body as a minister. He also suggested that there were in total 9 Cloud types, each defining a unique rainfall type each year. Although this almanac is ancient, as it happens, till date the people use it for various purposes like knowing their own future, for various rainfall related predictions etc. According to this almanac, a king, minister, and Megathipathi will be chosen for every year from a set of heavenly bodies, namely all the planets in our solar system like the sun, mars, moon, etc. Similarly, there are a variety of cloud types like Aavarta, Samvarta, Pushkara, Drona, Kaala, Neela, Varuna, Vayu, and Dhamo which are unique in giving the estimation of precipitation for a particular year. According to Parashara, the rainfall is measured in marakkal units, and each marakkal computes to 100 yojanas in height and 60 yojanas in width. This entire system works according to a cycle of complete 60 yrs. This is because, Jupiter requires 12 Earth Years to travel through all the 12 constellations (1 year for each constellation) and thus, completes one sidereal revolution around the Sun, Hence, in total the 5 complete rotations of Jupiter around the Sun add up to the 60- Earth year cycle in the ancient almanacs.

B. TRADITIONAL PANCHANG: -

The Traditional Panchang is an ancient almanac type, where a range of predictions from day to day to yearly are made related to the person's horoscope or the weather conditions for a particular year on a monthly basis.

Similar to the Tamil Panchangam, the Traditional Panchang starts from the month of April and ends with March. In this Panchang, rainfall is predicted using two features, firstly the 7 celestial bodies namely Sun, Moon, Mercury, Venus, Mars, Jupiter and Saturn and secondly the 27 Nakshatras and their 12 Zodiac Signs. Each zodiac sign equals 30o, hence combined they form 360o and each zodiac sign is divided into 2.25 nakshatras. Therefore, each nakshatra has a total of 13o 20’ of width. According to the Traditional Panchang, since the Sun, Moon, Mercury and Venus are the closest to Earth, these celestial bodies have a greater impact on the rainfall conditions on Earth than the rest of the celestial bodies. So, when the above celestial bodies come either in conjunction (the state where two celestial bodies are in the same sign or nakshatra) or individually in some specific zodiac signs or nakshatras, rainfall is observed on Earth. According to the Traditional Panchang, rainfall period on Earth starts when the Sun first

enters the Mruga Nakshatra on around the 7th June and ends when the Sun leaves the Swati nakshatra around the end of October, which is a period of 11 nakshatras. In this period, whenever the conjunctions of celestial bodies favouring rainfall happen, copious rainfall is noticed on Earth, however if some malefic (rainfall preventing) planetary conjunctions are observed, Scanty or Short rains are seen on Earth. However, there may also be a case where no celestial bodies are in conjunction with one another, so another theory that Traditional Panchang suggests is the division of 27 nakshatras into two categories, one where some nakshatras come under the Sun and the other where the rest come under the Moon. Now Moon, being the fastest celestial body to travel amongst all the others, travels through one nakshatra per day. Therefore, if no celestial bodies are in conjunction with one another, then the rainfall is predicted for the days when the Moon transits through the sun's nakshatras. This type of rainfall happens for a short amount of time, which can either be copious or scanty.

C. IMPORTANT PARAMETERS

1) ECLIPTIC LONGITUDE

Ecliptic Longitude is used to estimate the distance between two or more celestial bodies starting from a particular direction. The primary direction i.e., 0^o is achieved in the month of march, when the day and night are approximately of same length, which is commonly known as Vernal Equinox. By referring to this, we get to know the distance between two celestial bodies.

2) RIGHT ASCENSION

Right Ascension, along with declination is used to find the exact location or coordinates of a celestial body in space. It is measured in degrees or radians and it uses the east-west coordinate movement of the planets. The right ascension of a planet is in the range of 0^o to 360^o.

D. ZODIAC SIGNS WITH THEIR NAKSHATRAS

There are a total of 12 Zodiac Signs and each sign consists of 2.25(Pada) nakshatras.

Table 1. Zodiac Signs and Nakshatras

Sr No	Zodiac Signs	Nakshatras
1.	Aries	Ashwini Bharani Krittika (1st Pada)
2.	Taurus	Krittika (2nd,3rd and 4thPada) Rohini Mrigasira (1st and 2nd Pada)
3.	Gemini	Mrigasira (3rd and 4th Pada) Ardra Punarvasu (1st, 2nd,3rd Pada)
4.	Cancer	Punarvasu (4th Pada) Pushyami Ashlesha
5.	Leo	Makha Purva Uttara Phalguni (1st Pada)
6.	Virgo	Uttara Phalguni (2nd,3rd and 4thPada) Hasta Chitra (1st and 2nd Pada)
7.	Libra	Chitra (3rd and 4th Pada) Swati Visakha (1st, 2nd,3rd Pada)
8.	Scorpio	Visakha (4th Pada) Anuradha Jyeshtha
9.	Sagittarius	Mula Purvashadha Uttarashadha (2nd,3rd and 4thPada)
10.	Capricorn	Uttarashadha (1st Pada) Sravana Dhanishta (1st and 2nd Pada)
11.	Aquaris	Dhanishta (3rd and 4th Pada) Shatabhishak Purva (1st, 2nd,3rd Pada)
12.	Pisces	Purva (4th Pada) Uttara Proshtapada Revathi

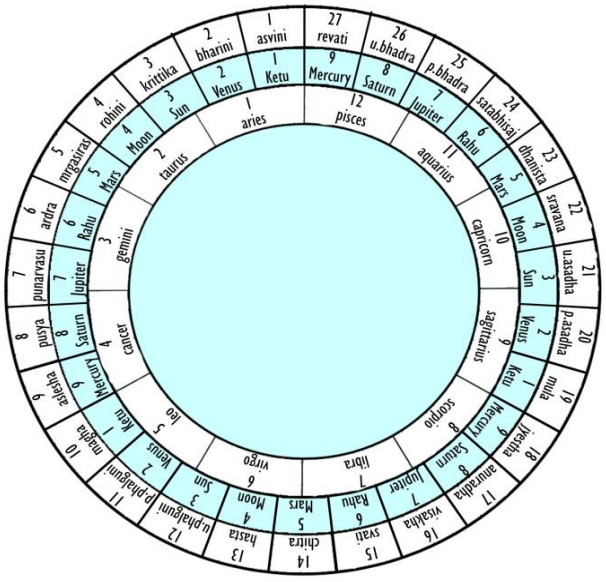

Figure 1. Zodiac Signs with their respective Nakshatras

E. *PROPOSED METHOD*

We have created algorithms for implementation purposes by studying how Panchang logic works and then converting that logic into programming code. These models have been created to be close to the real Panchang

prediction by incorporating as much logically inferable content as possible.

1). ALGORITHM FOR TAMIL PANCHANGAM

a) Enter the year.
b) Retrieve the ecliptic longitude (EL) and Right Ascension (RA) for the sun according to the location of the place for which prediction is to be made using PyEphem library.
c) Perform calculations to predict King, Megathipathi and Minister for the particular year.
d) Use predefined rainfall conditions (Table 2) based on King of the year to predict the rainfall for the year under consideration.

The rainfall conditions mentioned in the above algorithm are calculated as per the following table.

Table 2. Rainfall Conditions

CELESTIAL BODY	RAINFALL TYPE
Sun	Moderate
Moon	Very Heavy
Mars	Scanty
Mercury	Windy
Jupiter	Satisfactory
Venus	Heavy
Saturn	Very Scanty

2) *FLOWCHART FOR TAMIL PANCHANGAM*

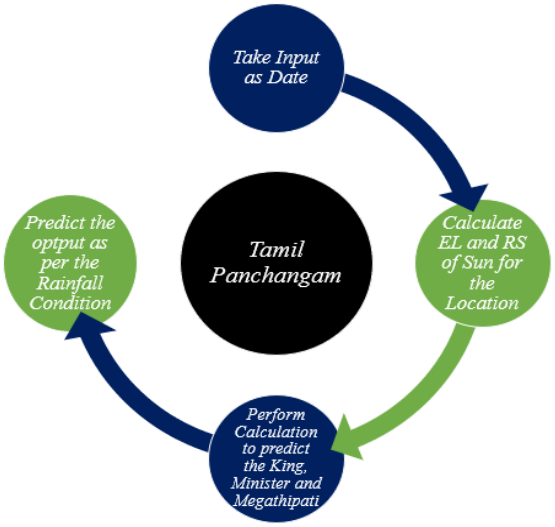

Figure 2. Flowchart for Tamil Panchangam

3). ALGORITHM FOR TRADITIONAL PANCHANG

a) Enter the date.
b) Retrieve the ecliptic longitude and Right Ascension for 7 major celestial bodies according to the location of the place for which prediction is to be made using the PyEphem Library.
c) Using the Ecliptic longitude, calculate the Nakshatra positions by dividing the ecliptic plane into 27 sections each occupying 13 degrees 20 minutes.
d) Now calculate constellations in which the celestial bodies reside.
e) Using rules as specified in Panchang check whether conjunctions are taking place and provide output accordingly.

4) FLOWCHART FOR TRADITIONAL PANCHANG

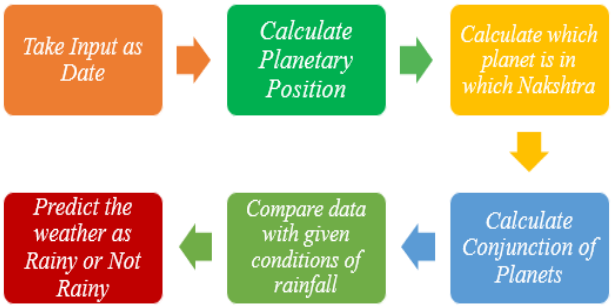

Figure 3. Flowchart for Traditional Panchangam

IV. RESULTS

Table 3. Key for Figure 4,5,6

CELESTIAL BODY	KEY
Sun	1
Moon	2
Mars	3
Mercury	4
Jupiter	5
Venus	6
Saturn	7

A. RESULTS FOR TAMIL PANCHANGAM

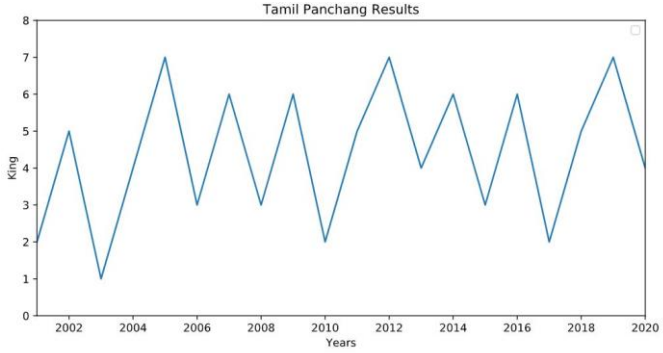

Figure 4. King suggested by our Model for respective years

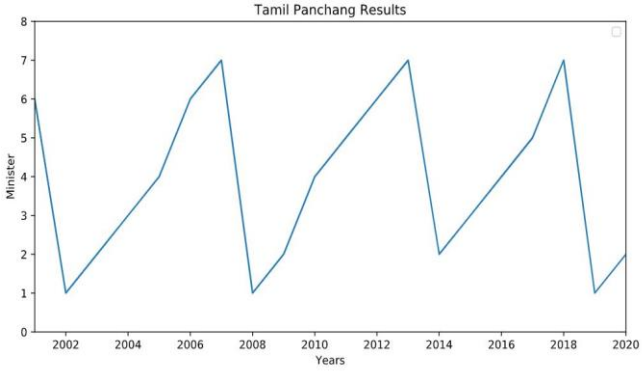

Figure 5. Minister suggested by our Model for respective years

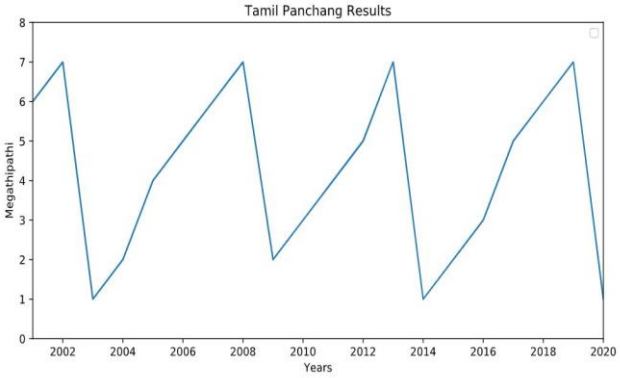

Figure 6. Megathipathi suggested by our Model for respective years

The graphs above depict the predictions of our Tamil Panchangam model for 3 arguments i.e., for King, Minister and Megathipathi over a period of 20 years.

Table 4. Test Cases with Results for Tamil Panchangam

Tamil Panchangam				
SR NO	Scenario	Input	Output	Result
1	Verifying for random years if the model predicts the King correctly.	Enter the Year to predict who the King is: 2020	Mercury	Success
2	Verifying for random years if the model predicts the Minister correctly.	Enter the Year to predict the Minister: 2020	Moon	Success
3	Verifying for random years if the model predicts the Megathipathi correctly.	Enter the Year to predict the Megathipathi: 2020	Sun	Success
4	Verifying for any random day if the model predicts the weather correctly.	Enter the Date to know the weather: 2020/12/17	No Rainfall	Success

Table 4. provides us with the test cases and results given by our model. Panchang/Panchangam being a theoretical method assures us of correct prediction for King, Minister and Megathipathi, if the logic has been used and implemented correctly. The rainfall prediction depends on the outcome of the king as stated in Table 2. The Minister and Megathipathi play supporting roles to the King causing different variations in the weather.

B. RESULT FOR TRADITIONAL PANCHANGAM

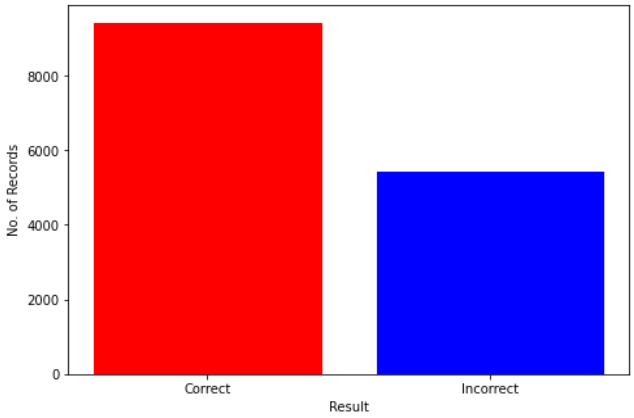

Figure 7. Exact Results of Traditional Panchang Model

So, the number of correct predictions for rainfall amounts to 9432 days represented by 'Correct' in the graph and incorrect predictions amounts to 5422 days as depicted by 'Incorrect' in the graph, the total number of observations being 14854 days. Therefore the current accuracy becomes-> (9432/14854)*100=63.49%. We have passed 40 years of data for the city of Pune to this model. The model returns a prediction out of three possible outcomes i.e. Copious, Scanty, No rainfall. The red bar displays the entire set of correct results containing all three outcomes. And the blue bar represents the incorrect results containing all three outcomes. To get a result, a complex set of decision making procedures are performed based on various conditions.

V. CONCLUSION

Thus, we have successfully been able to create prototypes for both the Panchang models stated above. We have achieved a respectable accuracy of 63.49% (Figure 7) for Traditional Panchang when tested on data pertaining to a single city (Pune) and a perfect result for Tamil Panchangam based on Test cases (Table 4). The limitation of these types of models is that they are theoretical models and instead of using past and current actual weather data like pressure, temperature etc. for predictions, they make use of conjunctions and Astronomical observations. This may cause some differences between the predictions of Panchang models and the weather being observed. Additionally, changes in climate conditions due to pollution in present times have also affected the predictions received from Panchang/Panchangam. As for the future scope of improvement, we now intend to modify the combination of rules and conditions to get an improvement in the predictions and improve the accuracy of our models. We will try to test it over multiple cities to measure its significance over different areas.

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