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Web Scraping Techniques to Collect Weather Data in South Sumatera

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Abstract—In some cities in South Sumatra has several weather measurement points owned by several different institutions such as BMKG, AngkasaPura, Lapan, and others. However, to get the latest weather data in detail within a specified period constrained the bureaucratic process to each institution. While the availability of weather datasets is needed in conducting researches in the field of data analytics to predict the weather and analyses for DSS that require weather patterns. On the other hand, some websites provide real-time weather data for some cities. For that in this research, we use web scraping technology to collect weather data in some cities in South Sumatera surrounding on some websites. Web scraping technology is a technique for retrieving the contents of a web page individually. The data collected by this web scraping technique will form a database or data warehouse that can be used for further research for weather forecast data mining in South Sumatera, which in the future can be developed weather-based decision support application.

Keywords—component; formatting; style; styling; insert (key words)

I. INTRODUCTION

Weather forecasts have an essential impact on humans, especially in the economic and social sphere. By collecting weather data allows us to analyze patterns of data from annual weather data that affect temperature patterns and precipitation. Some research utilizing weather patterns are used to study weather patterns for agricultural use [1], in health [2], transportation [3], [4], city planning[5]. To estimate the weather itself is not easy because the weather is always changing and also influenced by the nature of the atmosphere or the dynamics of the atmosphere. Approaches in making weather forecasts are highly dependent on observed data and the procedures and methods of weather forecasting used. The data is necessary to measure data not only at one point to strengthen the weather forecast analysis. We need to measure datas at some points to see the movement of the atmosphere, the flow of clouds, wind, etc. so that the weather forecast is valid.

In South Sumatra itself has several weather measurement points owned by several different agencies such as BMKG, AngkasaPura, Lapan, and others. However, to get the latest weather data in detail in a certain period is very difficult due to the bureaucratic process to each different agencies. On the other hand, some of the sites like <https://weather.com>,

<https://www.accuweather.com>, <https://www.timeanddate.com>, <https://www.worldweatheronline.com>, provide updated weather data by online.

For that in this research will utilize web scraping technology to collect data from sites that provide real-time data. The web scraping technique is a technique that makes it possible to extract data from multiple websites into one database or one spreadsheet making it easier to analyze and visualize the data collected. The data collected by this web scraping technique will form a database or weather dataset. This research is a preliminary research to prepare the weather dataset that will be used for further research to research the analytical data for South Sumatera weather forecast, as well as weather patterns that can be utilized for decision development.

II. PREVIOUS WORK

Web scraping is a data collection technique with a program that interacts with the API (application programming interface) The web scraping technique is mostly done by creating programs that automatically run queries to the web server, requesting data (usually in HTML and other forms of web pages), then parses the data to extract the necessary information[6]. In practice, web scraping uses various programming and technology techniques, such as data analysis, natural language parsing and information security.

Some research that explains the techniques of web scraping techniques such as Fernandez et al. [7] discusses the various aspects of web scraping semantics and the sentimental approach undertaken. Other studies examined tools and techniques that could be used to run web scraping [8], [9], [10]. Many devices and methods are available which are mostly free and easy to use. Johnson and Gupta research web content mining techniques and connect with existing scraping tools. In his paper, many discuss the topic of data mining that exposes taxonomy in web mining and compare it with web scraping.

Issues of utilization The web scraping technique itself is widely discussed in several papers. Pereira in their article [9] presents the tools and techniques used for scraping and its impact on social networks. Other Utilization Techniques are used to collect rental listing data from Craigslist web site [11]. The data collected is used to analyze the housing market, urban dynamic, and human behavior. Polidoro et al. [12] performs a

web scraping technique for conducting consumer price surveys concerning consumer electronics products (goods) and airfares. The results show statistical data obtained with web scraping techniques saving time.

In some research also web scraping techniques are used to search for literature, as in Haddaway study [13] which uses import.io to examine gray literature. Josi et al. [14] conducted a similar research who conducted an article search with web scraping on Garuda, ISJD and Google Scholar portals. The search for specific research data in the field of Psychological is done by Landers et al. [15]. While Marres[16] conducted research using scraping techniques to seek linkage issue in live social research.

The utilization of web scraping associated with weather data is carried out by Novkovic et al. [4]. In his research web scraping is used to collect traffic accident data for 15 years and relate it to meteorological data. The results show using datamining there are linkages of several weather variables with the level of traffic accident.

III. WEB SCRAPING WEATHER DATA

The development of weather data web scraping is included in the field of field study research [17]. Field study research is common for research in the area of software systems, especially for software development. As for software development models that are used using incremental models. This incremental model divides the phase of software development in stages according to its function. With this gradual development, there can be changes in each step of increments [18].

The system developed in this research is the initial phase or incremental phase 1. In this initial stage the development of a weather database in South Sumatra with a web scraping technique. In the next step, data collected in the first phase will be forwarded to the development of a weather prediction system. In the last stage, a weather-based Decision Support System will be developed.

For database development such as the stages of software development in general through the phases of analysis, design, coding, and testing. In detail, the process carried out in progress can be seen in Figure 1.

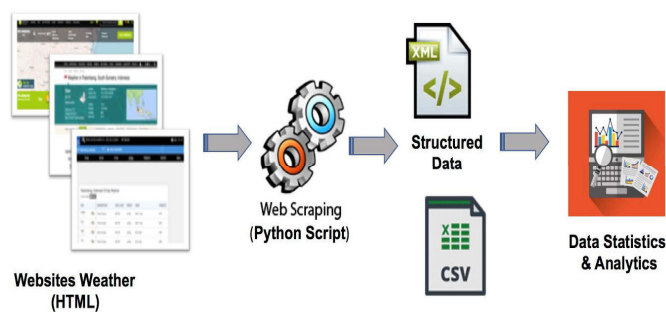


Fig. 1. Web Scraping weather Data Process

The process of web scraping weather data can be seen in Figure 1, which in detail consists of several stages as follows:

- The early stages in the Analysis phase is studying the structure of HTML documents from all websites that will be scraped. This process is done to sort the data and elements to be retrieved or stored.
- The next step is to create a crawling program created with Python script using the BeautifulSoup and Requests library. The results of the scraping data are stored in the excel file.
- Create Task Scheduler to run scripting data scraping periodically every 1 hour. Auto task scheduler will perform scraping data throughout the website and save it into the results file.
- The next process of web scraping is to extract the crawling data. Extraction process is done with the help of tools Pentaho Kettle. From the data obtained is done cleaning process to remove unnecessary information such as units of the stored variables. Transform data to adjust formats and data structures as needed (e.g., city data, time format, date and more). And do the process of merging documents to unify the files scraping into one file to facilitate the analysis process.
- Create statistics of weather data and analysis of data obtained according to the needs of application development.

IV. RESULTS

A. Web Scraping Process Weather Data

Web Weather Scraping Application developed using HTML Parsing created in Python programming language in Anaconda platform running on Windows Operating System 10. Script created using BeautifulSoup 4 library (<https://www.crummy.com/software/BeautifulSoup/>) and the Requests library. The sites in scraping are <https://www.worldweatheronline.com>, <https://www.timeanddate.com>, and <https://weather.com>. Created two scripts to perform data scraping.

- The first script will scrap the data on the website worldweatheronline.com for eight cities in South Sumatera covering the cities of Palembang, Indralaya, Prabumulih, Lahat, Baturaja, PagarAlam, TulungSelapan, and LubukLinggau. The stored data variable consists of 13 variables (Gust, Percept, Humidity, Time, Wind, Weather Forecast, Rain, Pressure, Feels, Temperature, Cold, Date and Wind direction). The variable date is obtained by running the date time function converted to time based on timezone in Asia / Jakarta.
- The second step script to collect data Palembang city in get from Weather Station Sultan Mahmud Badarudin II for website time and date and weather.com. For time and date websites there are 11 variables stored (Dew_point, Fells_des, Humidity, Temperature, Forecast, Wind, Weather Description, Hour, Visibility, Pressure, Date). While on the weather.com website, we store eight variables (Feels, Temperature, Description, Hour, Date, Precept, Wind, Humidity).

To run Script crawling data automatically and done periodically every hour, so in this research, the researcher do hosting Python script in Python server anywhere <https://www.pythonanywhere.com/>. We create task scheduler that will run the script continuously every hour. This task scheduler will run both scripts automatically every hour

B. Data Extraction and Transformation

Results from the data files obtained from the scraping process cannot be directly used for the analytics process because there are units on the data variable taken. Also, it also needs to adjust the format of the data read. In Process data transformation and extraction, we use tools Pentaho Data Integration (in this study using PDI version 5.0.1.).

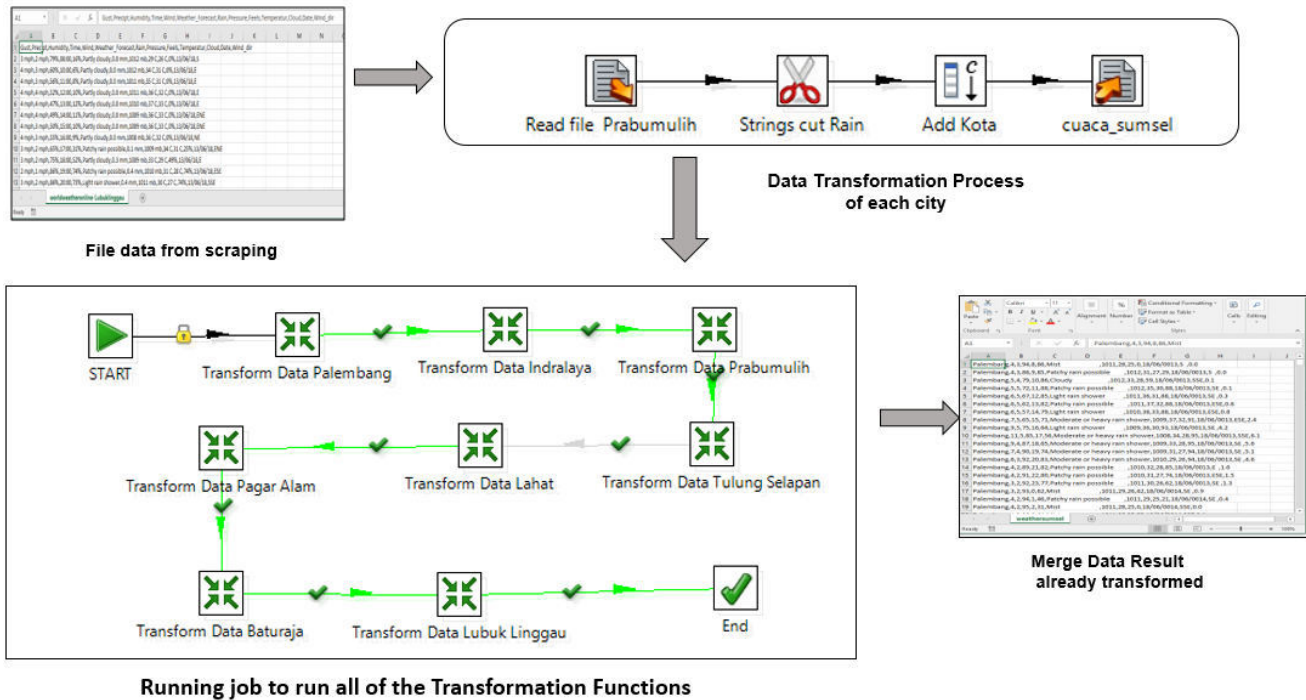


Fig. 2. Weather Data extraction and Transformation process worldweatheronline.com

The ETL process (Extract Transform Load) performed for the online weather data can be seen in Figure 2. This ETL process will extract data from scraping, transforming data by converting data into a form that can be processed. The data load process is the final process for integrating data and presenting data. In detail, the steps of the ETL process are as follows:

- The Transformation process is done by creating a data transformation file for eight cities. The transformation process of one city will read the resulting file from the extraction data for each city as example Prabumulih file. The result of first step is to read the csv file and then change the data format as needed. The next step process is to do data cleaning (remove the unit from data variable). Continued stepStrings Cut Rain that transforms rainy field data to get output by the chill. The next step add Kota will add description of city data and latitude (if needed). And the last result will be saved in the weather sumsselfile.
- To run the entire transformation process, a job that will run the whole city transformation process in sequence. The process is done sequentially rather than simultaneously to avoid data conflicts caused by file access simultaneously.

The result of this ETL process will generate the weathersumsel.csv file which is the result file for the eight observed cities ready for use in the analytics data process. This job process itself can be combined with the job to download the files scraping to the local computer on a scheduled basis. Job process can run automatically with task scheduler. For example, the schedule of adding data for analytics done every day at certain hours. The job will run automatic after the process of extracting the download is done.

The ETL process for the data scraping results from weather.com and timeanddate.com results are similar to the above method. But the process is more straightforward. In both files are only done cleaning process, extract and transform without merging the data.

C. Data Statistic and Analytic Process

The results of data collected by web scraping techniques can then be presented in the form of statistics. Data statistics are created using Python programming language. Data can be performed as needed by doing the process of data grouping.

City	Date	Temperature			Humidity			Pressure	
		Temperatur_min	Temperatur_mean	Temperatur_max	Humidity_min	Humidity_mean	Humidity_max	Pressure_min	Pr
Baturaja	2018-06-13	23	27.875000	33	50	80.125000	98	1008	
	2018-06-14	23	26.875000	32	56	82.625000	98	1008	
	2018-06-15	23	27.391304	35	46	79.391304	98	1009	
	2018-06-16	23	27.291667	34	46	79.125000	99	1008	
	2018-06-17	23	26.666667	33	51	85.916667	99	1007	
	2018-06-18	22	26.833333	33	52	83.208333	99	1008	
	2018-06-19	22	27.000000	33	42	76.875000	98	1008	
	2018-06-20	22	27.000000	33	50	79.666667	98	1009	

Fig. 3. Presentation Example of data in table form for analytics purposes

For analytics data can be presented in the way of a table as in Figure 4 or the type of graphs and charts.

Other forms of statistical data in this study are also presented in the way of charts and graphics as shown in Figure 4. With the presentation in the form of histogram make it easier for users to see the statistics of weather data from each city to be observed. Also, the histogram can be presented in daily, monthly and yearly forms as required by using the group function by the Date variable.

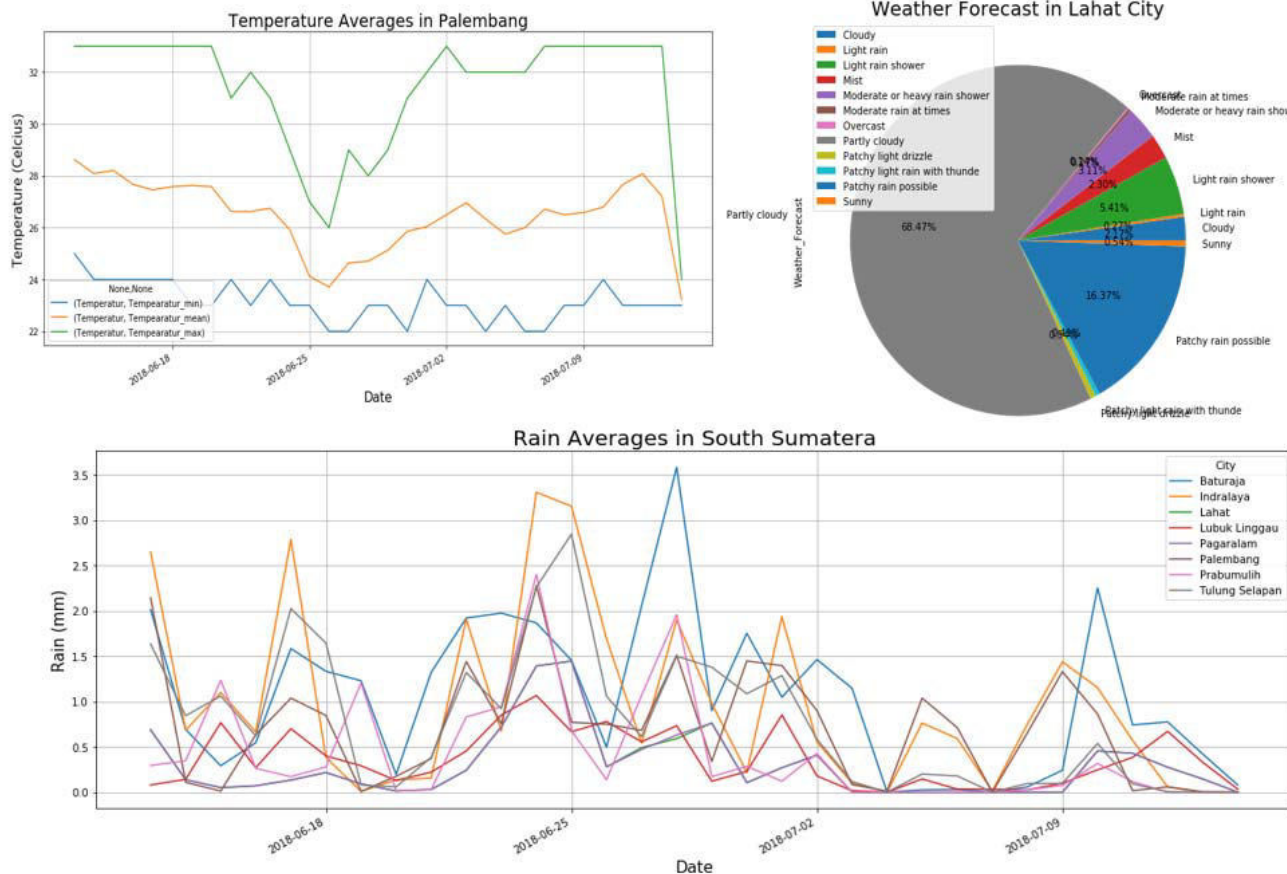


Fig. 4. Statistics Data presented in the form of Chart and Graph

The study itself is a new preliminary study to the stage of collecting weather data in South Sumatra. Therefore, the process of analytics data for collected weather data is still limited to the presentation of statistical information. While the analytic method in detail for example for weather prediction, weather pattern mapping cannot be done. This is because the weather data collection period that runs only run one month. So the data collected is still relatively small (5909 records). The data cannot be used to make predictions and weather forecasts. Because the prediction process itself ideally uses a lot of weather data to produce accurate estimates of good results. For the future data collection process with web scraping techniques will continue to be done continuously. After the data collected enough (more than one year), then the next stage of research will be made

weather prediction using the approach of data mining and machine learning. Also, the future results of data collected by web scraping techniques will also be used to study the relevance of weather patterns for decision making in the field of transportation and agriculture.

D. Legal Aspect Issues

The legality and fair use of the use of web scraping techniques is often an issue. There are two aspects to consider in doing web scraping techniques, namely copyright and entry without permission [19].

- First for copyright issues, in the case of *Craigslist Inc. v. 3Taps Inc.* (2013), a federal district court ruling on scraping data is not a copyright infringement for

publicly available data. In the study of the use of web scraping techniques in this weather data, the scraping website presents data publicly. Also, this research does access on a regular basis, does not burden the site (only one request per hour) and does not damage the website hosts of the accessed data.

- For the second aspect, enter without permission. In the process of scraping web that we made the website accessible publicly accessible freely. It is not being a parasite for host data. IP used at the time of the research is not a blocked IP, and access is done without having to bypass any proxy and the data accessed is not encrypted data. So from the aspect of the legality of the web scraping process is done does not violate anything. The results of data collected are not used for commercial purposes but research purposes. The research process also does not repack or repeat the data but to be analyzed.

V. CONCLUSION AND FUTURE WORKS

In this research web scraping techniques successfully utilized to collect weather data in several cities in South Sumatra. The process of web scraping is done to collect data from several websites that present weather data. The web scraping model using the Python programming language manages to collect data automatically and continuously every hour. And the resulting data is very detailed and can be used further for data analytics.

Limitations of current research are newly generated analytics data in the form of statistical data due to the short period of data collection that has been running (1 month). The data collection process will continue to run to produce the weather dataset of cities in South Sumatra. Once the datasets are collected, considerable research will be developed to predict the weather as well as weather patterns analysis for decision making in agriculture and transportation.

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Web Scraping Techniques to Collect Weather Data in South Sumatera

3 Author(s) Fatmasari ; Yesi Novaria Kunang ; Susan Dian Purnamasari [View All Authors](#)



Abstract

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In some cities in South Sumatra has several weather measurement points owned by several different institutions such as BMKG, AngkasaPura, Lapan, and others. However, to get the latest weather data in detail within a specified period constrained the bureaucratic process to each institution. While the availability of weather datasets is needed in conducting researches in the field of data analytics to predict the weather

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and analyses for DSS that require weather patterns. On the other hand, some websites provide real-time weather data for some cities. For that in this research, we use web scraping technology to collect weather data in some cities in South Sumatera surrounding on some websites. Web scraping technology is a technique for retrieving the contents of a web page individually. The data collected by this web scraping technique will form a database or data warehouse that can be used for further research for weather forecast data mining in South Sumatra, which in the future can be developed weather-based decision support application.

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I. Introduction

Weather forecasts have an essential impact on humans, especially in the economic and social sphere. By collecting weather data allows us to analyze patterns of data from annual weather data that affect temperature patterns and precipitation. Some research utilizing weather patterns are used to study weather patterns for agricultural use [1], in health [2], transportation [3], [4], city planning [5]. To estimate the weather itself is not easy because the weather is always changing and also influence the dynamics of the atmosphere. Approaches in making weather forecasts are highly dependent on observed data and the procedures and methods of weather forecasting used.

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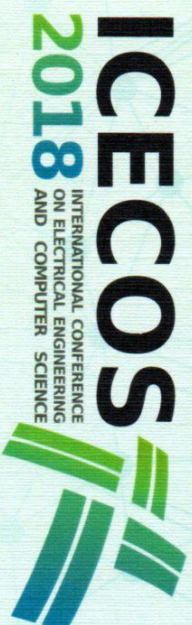
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