Characterization of Pattern for Predicting Ultra Violet (UV) Effects in Environment Data Management System (EDMS)

M. Amir Abas[1], M. Dahlui[2]

***Abstract*—**This paper presents the development of analysis tools for predicting ultra violet (UV) effects through statistical pattern recognition technique. The increasing phenomena of UV level in many areas have severe implications especially to the weather and on the people. An effective measurement system; Environment Data Management System (EDMS) had been designed to monitor the UV level so that preventive and control measures could be taken up. This system is capable of measuring, processing and analyzing the environment data. Data will be processed through analysis tools, utilizing the statistics pattern recognition technique. The pattern recognition was executed by comparing the month to month or year to year measurement data. The performance of the system in measuring the effect of high UV to the environment had been evaluated in a case study, whereby the monitoring of UV and its effects had been conducted at Rawang. Rawang was chosen for its rapid development which had changed its status from the green tropical area to a polluted semi-industrial area. Her relatively big population size, many new housing estates, many vehicles and factories, and several construction sites had contributed to the climax change. The measurement system EDMS could integrate all these factors to analyze the effect and subsequently can be used to relate with the current weather and recent human diseases especially skin cancer and eye cataract. The result of the measurement exercises produced various patterns, each with unique identification for developing database pattern algorithm. Statistical analysis graph was plotted to justify the one year measurement of UV, temperature and humidity.

***Keywords*—** Pattern, Monitoring, Measurement, Recognition, Formulation.

I. Introduction

Advancement of software compilers provides new ventures for Engineers to innovate applications with more sophisticated features. One of the recent support packages that are freely available is web based compiler. The uniqueness of the compiler is the supporting tool built in package for the development of Graphic User Interface (GUI).Web base application create new window for speeding up the software development for web access. The application is designed as usual but ready for web activation once completed. Open access package such as Visual Studio allow the user to freely download and used for web based application.

Monitoring strategy through web based would enhance the effectiveness of controlling the result. Action could be taken immediately even the person is away from the main system. This would ensure the critical situation is fully monitored and taken care. One of the issues under studied is monitoring climax effects associated with global warming. Climax effects involve changes of temperature due to ozone layer degradation, carbonization, pollution, acidic rain and many others things. These problems seem unstoppable and worsen even though environment policies have been enforced to ensure pollution to environment is minimized. Related to a device is required to monitor the effect continuously. The recognition of the changes could be materialized by implementing pattern recognition tools within the system. Pattern recognition technique through statistical analysis [10] has become an attractive solution in many automated system. Hence the research project is aimed to explore pattern through measurement of environment parameters for recognizing the climax effect. Through this technique some measurement data have been collected which then becomes the main subject to develop patterns associated with the climax changes.

Environment Data Measurement System (EDMS) is designed to support the analysis of Environment data [4]. The EDMS includes sensor devices, fundamental structure of the sensors, sensor interfacing circuit, memory devices for data storage and the control board. Three different sensors have been used namely humidity, temperature and irradiance. Apparently there are two categories of sensor with regards to their structure and operation. First the sensor is generating analog signal which is manned for further amplifying before being convert to digital form by ADC. This sensor requires calibration in order to ensure high accuracy of measurement. Two components involved in calibration are the pre-amplifier and DAC. Second type of sensor has advanced structure with integrated internal memories for data storage and control unit. This type of sensor is known as one wire sensor. The sensor communicates via serial com or one wire with main control board which makes the implementation becomes simpler.

The next section of this article highlights the measurement exercise for sampling environment data. Section 3 describes

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the experimental set-up of the measurement system and followed by measurement result carried out at Templer, Rawang. Section 4, 5 and 6 highlight the patterns that have been formulated from the measurement data. Final section shares the discussion of the investigation and next process of EDMS development works.

II. Procedure for Paper Submission

Cameron Highlands is the largest and most famous hill resort of Malaysia with 1500 meters above sea level. Aggressive timber logging is carried out for new area of plantation. The measurement was proposed with the aim to explore the effect of the logging activities to the environmental parameters. Data concerning all the environmental issues includes temperature, humidity, Ultra Violet and air quality will be measured and analyzed. Population of common disease due to sun exposure e.g. skin cancer will also be gathered. Correlation between the changes of environmental parameters issues and the population of the disease will be analyzed at the end of this case study.

The first data measurement has been carried out at Tanah Rata, Cameron Highlands on 30th Dec 2009. The measurement using the developed system was focusing on measuring three environment parameters which include temperature, humidity and irradiance.

The second location of measurement was Templer Park, Rawang. Templer's park is a forest reserve in the Klang Valley, Selangor, Malaysia. The park is located about 6 kilometres from Rawang and 22 kilometres from Kuala Lumpur. It is 1,214 hectares in size. This forest reserve consists of multi-tiered waterfalls, jungle streams and trails. Several amenities are available in this forest reserve, such as picnic grounds, fishing spots, parking lots, public toilets and stalls. The weather is intermediate throughout the year and rain fall is quite heavy. The location is above 100 m sea levels and close to Genting Highlands.

Templer's park has been aggressively developed for the last few years especially the housing demand and industries. One of the heavy polluted industries is the cement factory. The factory has been observed to release smoke and dust regularly especially at night. Therefore the objective of the data measurement exercise is to study the effect of ozone associated with the smoke released by the cement factory.

III. Experimental Set-Up

The system [3] was set up to carry out long data measurement and also to investigate the reliability of the system for long period of operation. The location was identified strategically at the top of building (flat roof) where the sun exposure is fully obtained during daytime. The data logger is powered up by a Solar Panel 90 watt to charge the batteries during day time. It has been estimated that the batteries with full charged could survive the system for 7 days.

a. Capacity of the batteries - 14 AH 12 V (168 watt)
b. Power Consumed by the Data Logger ....200 mA x 5 V (1.0 watt)
c. Days of power consumed by the Data Logger ..... 168/1 x 1 H/24 = 7 days

The final setup of the data logger is shown in Fig. 1. The structure of the data logger is made from the stainless steel to ensure minimum rusty problem. The panel is geared down by using worm gear for braking condition while without power.

Fig. 1: Data Logger Location and Set-up

IV. MEASUREMENT RESULTS

Measurement exercise was carried out from 1st Jan 2012 until 31 Jan 2013. The location of the measurement was in Templer, Rawang, Selangor. Rawang is considered small industrial area and located nearby Genting Highlands. The weather is moderate at 20°C to 45°C throughout the year. Two days monitoring graph is shown in Figure 2. The graph is generated from EDMS system shows combination of three measurements. The first day (31st Dec 2010) indicates heavy rain causes the temperature raised to 35°C max while the humidity reading is down to 54 %. The irradiance is low 0.3 kW/m^2 due to the sun is entirely covered by the heavy clouds. The next day (1^{st} Jan 2011) was totally different weather condition where the sun is fully bright and this cause the irradiance swing to 1.2 kW/m^2.

Figure 3 and 4 are individual irradiance graph for four conditions of weather. Apparently each graph has unique pattern which could be used to predict weather condition. For instance the first peak graph shows bright day in the morning and raining day in the evening. The second peak is clearly indicates the weather is cloudy throughout the daytime.

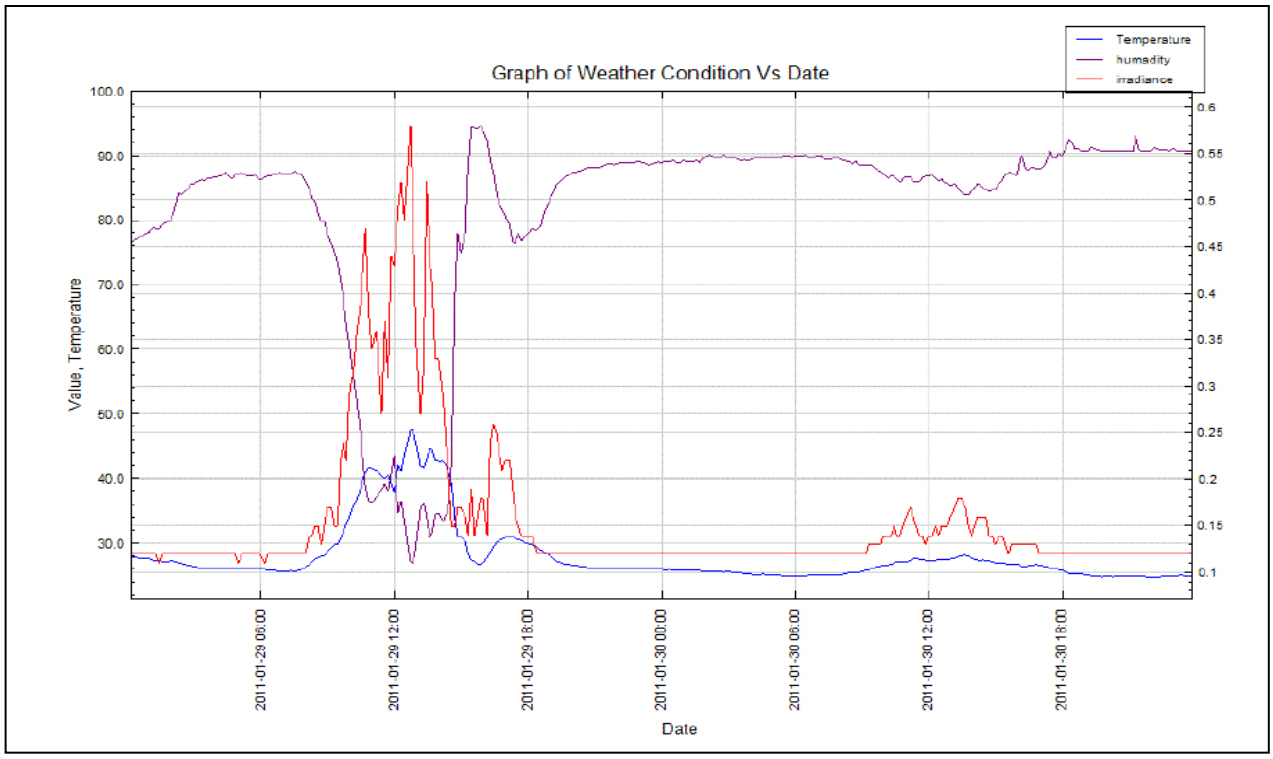


Fig. 2: EDM Measurement for 2 Days

The third peak shows the daytime is hot with clear sunshine. While the fourth peak is similar as first peak but less raining in the evening. These patterns are applied to formulate the pattern algorithm for analyzing the duration of UV exposure to weather and environment.

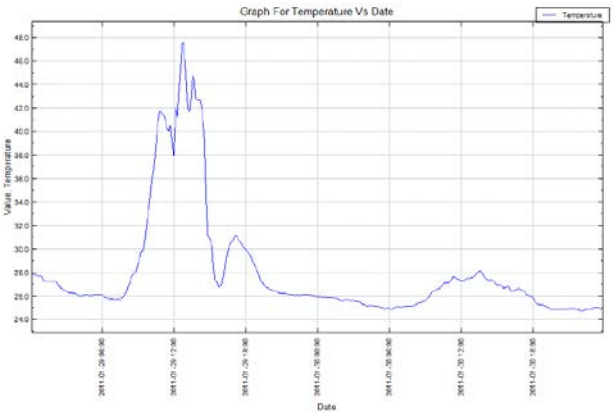


Fig. 3: Two days Data Measurement (Cloudy and Raining)

The next characteristic for pattern algorithm is the frequency of peak against month and year. The significant of these values will indicate the changes of climax on year by year basis. Climax change is caused by many factors such as drastic development, ozone effect, ignition of carbon, land development and etc. Since the target area is suffering huge development recently, it is very important to study the effect.

Comparison on year to year basis could be vital because the change of climax particular in tropical country is very slow. Measuring and monitoring through EDMS would produce significant justification on the changes. The results are so important to convince especially the authorized personnel who look after the quality of environment and climax control before the situation is entirely damaged.

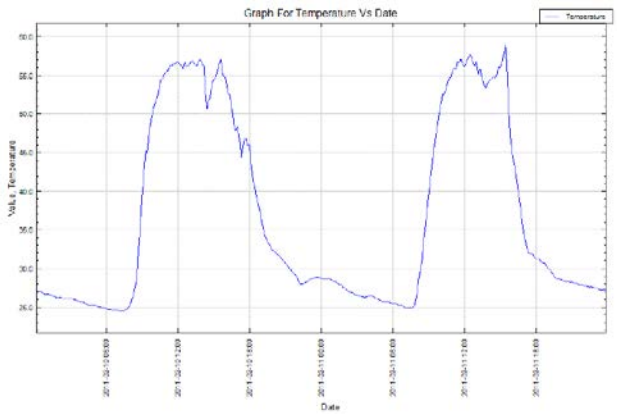
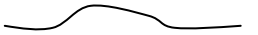
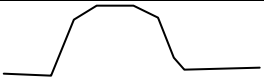
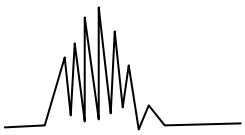
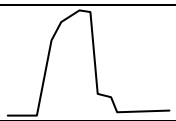
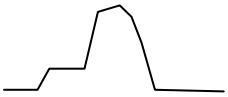


Fig. 4: Two days Data Measurement (two hot days)

V. Pattern Formulation

The graph indicates some patterns that represent the daily event such as bright day, raining, cloudy and combination of events. In short Table 1 summarizes the daily event with regard to the pattern of the graph.

TABLE 1: DAILY PATTERN AND INTERPRETATION

No	Graph Pattern	Event
1		Bright throughout the day
2		Cloudy and raining
3		Cloudy but not raining
4		Semi-Cloudy
5		Bright and raining towards the end
7		Bright in the morning, raining in the afternoon and bright at late evening
8		Raining in the morning and bright in the afternoon

The formulation of the pattern could be transforms as an equation or few equations. The equations are applied as analysis tools in the EDMS. Prediction and analysis tools become the mechanism for the entire software application to justify the effect of UV in environment and human.

EDMS could also predict climax effect through monthly and yearly monitoring. The comparison of graph for monthly basis would easily recognize the changes which could be correlated with the development activities. However the effect of climax due to industrial activities is normally slow. Monthly monitoring may not able to detect the effect. Hence yearly monitoring is more viable which would see the raising of temperature and irradiance.

Throughout the year of 2012 the EDMS has been used to measure thirteen month data starting from Jan 2012 till Jan 2013. Data measurement for Rawang area has been carried out to study the trend of weather particularly on three parameters namely temperature, humidity and irradiance. The conversion of raw data was done by the EDMS and the results are shown in Figure 5, 6 and 7.

Figure 5 shows the measurement for peak irradiance from Jan 2012 till Mac 2012. Irradiance is the strength of sun intensity which is measured using Pyranometer [5]. The reading is in kW/m^2 with the measureable range from 0.0 kW/m^2 to 1.6 kW/m^2. Normal irradiance reading for good weather is 0.9 to1.2 kW/m^2. Reading which is beyond 1.2 kW/m^2 indicates that the weather is extremely hot. While reading that shows below 0.3 kW/m^2 indicates the weather is cloudy and raining.

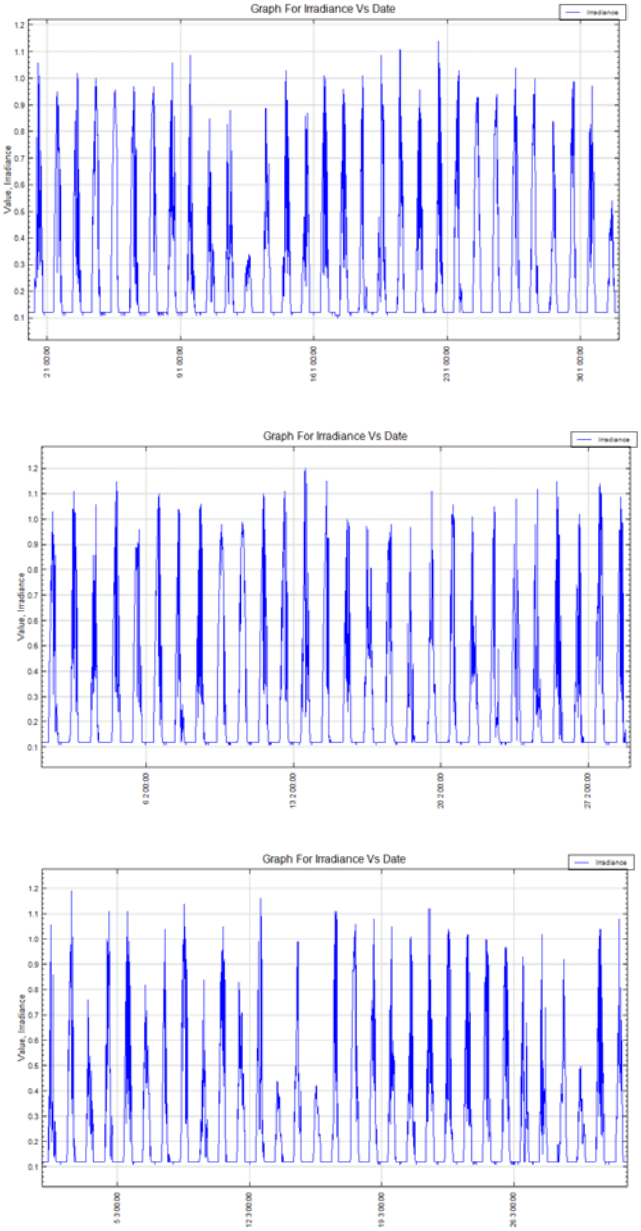


Fig. 5: Peak Irradiance Population for Jan, Feb, March 2012

Average reading for Jan and Mac are normal while in Feb the reading is consistent above 1.0 kW/m2. Significantly the number of peaks (< 1.0 kW/ m^2) in Feb is high compared to Jan and March. This is due to less raining while in Jan and March the weather is much pleasant. Hence the frequency for high peaks is calculated to justify the condition of weather, climax changes in the EDMS system.

Besides irradiance, the EDMS is also used to analyse humidity and temperature parameters. Figure 6 and 7 show the

analysis graph for humidity and temperature respectively. Humidity is a percentage of water in air while the temperature is measured in Celsius. The Peak reading for humidity and temperature during day time and night time could be easily recognized through the graph. In tropical climax humidity is low (lowest 40 %) and temperature is high (highest 36.5°C) during day time while during night time humidity reading is high (highest = 76%) and temperature is low (28°C).

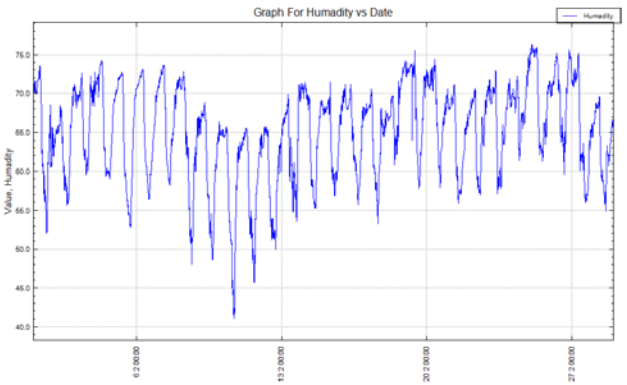


Fig. 6: Peak Temperature Population from Jan 2012

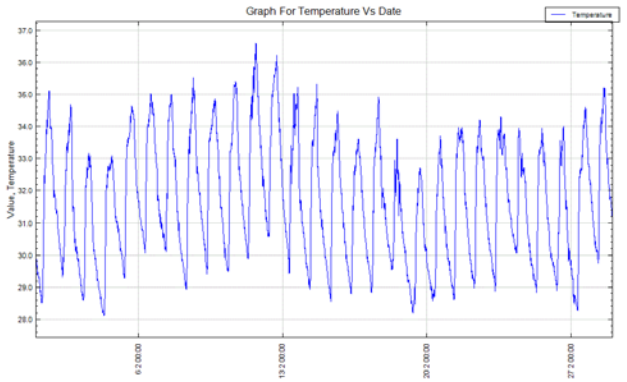


Fig. 7: Peak Humidity Population from Jan 2012

VI. Peak Irradiance Population Statistical Analysis Tool

The conversion data was saved in Excel format. Therefore it can be easily analysed through Microsoft office tools such as histogram, pie chart and etc. The tool is designed in EDMS to generate classification graph to highlight the population range of peak irradiance as shown in Fig. 8. Each range has been set with margin from 0.2 to 0.3 kW/m^2. Analysis is carried out to monitor the range through-out the year. The most significant ranges are 0.6 - 0.9 kW/m^2, 0.9 - 1.1 kW/m^2 and 1.1 - 1.3 kW/m^2. The first range 0.6 - 0.9 kW/m^2 is the most comfortable weather for tropical area while the third range is considered hot weather through-out the year. From the graph it is clearly shows that the frequency for second range (0.9-1.1 kW/m^2) is gradually going down. In Jan 2012 Rawang has been in very active development for LATAR highway project. This project cause huge clear up of green land at Templer area. However the project has been completed and the green area is slowly grown back and as a result reduces the reflection of the sun intensity. The low range 0.6 – 0.9 kW/m^2 is overtaking the higher range on Jan 2013. This indicates that the area is improving and becomes colder.

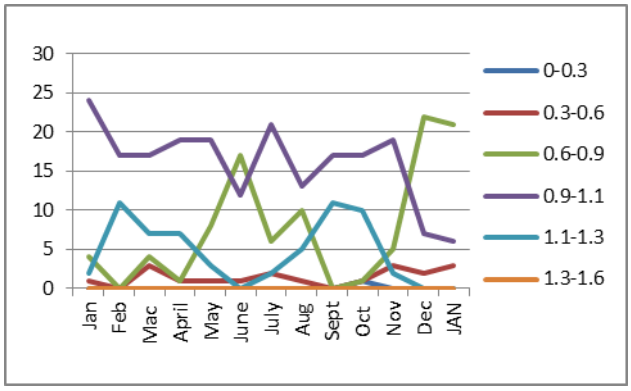


Fig. 8: Yearly Comparison Range from Jan 2012 till Jan 2013

VII. Discussion

The main focus of this particular study is to develop a comprehensive analysis tools for measurement, data conversion, data analysis and data prediction. The system is known as EDMS which is still in developing stage. The development of the EDMS tools is supported by a Visual Studio VB compiler. The first function of the EDMS is to convert raw data into data in Excel format. The raw data is in text file as saved by the data logger. The second tool is to arrange the data according to day, month or year. This arrangement is required to facilitate graph plotting and analysis process.

Two data characterization have been identified for supporting the formulation of analysis algorithm process in EDMS. The first manifestation is based on the pattern of data interpreting daily event such as raining, cloudy, bright day and combination of the different events. Each event has unique shape and could be easily recognized through analysis algorithm. The next characterization tool is to monitor the frequency of peak for UV intensity. This analysis algorithm is formulated by comparing year to year histogram data. In the analysis the main mechanism is to correlate between the environment and the condition of weather. It is norm that the temperature is high when the area is exposed with high UV level. For instance the area which has less green is much hotter compared to the area with fully green. Changes may happened when the location has drastic development which cause the UV population increased than the past year measurement.

The next step of EDMS is applying the pattern in the analysis tool for climax forecast, UV monitoring, and environment changes monitoring. This integration would establish the software for specific monitoring of UV in the future.

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