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Research paper

Mobile Crowd Sensing Application for Noise Monitoring in Kuala Lumpur

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Abstract

Mobile Crowd Sensing (MCS) technology enables mobile devices, such as smart-phones or other android-based devices that are equipped with embedded sensors to gather relevant data for research work. Typically, the MCS application field ranges from online social-media monitoring, transportation system monitoring, atmosphere monitoring and etc. The inherent attributes of MCS applications is the ability of the system to monitor and collect data over a huge geographical area. Generally, the planners of MCS select participants based upon the scope of survey or the type of data to be acquired. Consequently, based on user's movement behaviour and location, the MCS application running on the background is able to discreetly collects data from the proximate areas. In principle, this research work highlights the development of MCS application, using the noise parameter as input. The research work shows the feasibility of MCS for data gathering. However, it is essential that data obtained from smartphone's sensor i.e. microphone is properly processed. Basically, the MCS application is designed to be able to interact with the sensor components within the smartphone. Data is collected and has to be periodically uploaded to the server, where analytical operation is undertaken to produce meaningful information. In principle, the MCS application is able to provide viable noise data in many different areas in Kuala Lumpur. The main benefit that the MCS application can offer is the ability to provide continuous data collection with minimal resource needed.

Keywords: *Mobile Crowd Sensing, Noise pollution, Kuala Lumpur, Sensors*

1. Introduction

Mobile sensing has changed many into different systems over the years. With the advancement in mobile computing, many sensors are nowadays available is small form factor. Due to the diminutive size of such sensors, several mobile applications can be developed for mobile non-commercial use e.g., to measure different environment variables such as air contamination, temperature, humidity and pressure. In addition, improved cellular and broadband technologies has alleviated many issues in terms of connectivity particularly for data transmission. Furthermore, built-in sensors attached within the smartphone can now be efficiently interconnected to other sensors and as well as with the central servers [1]. As such, many MCS applications developed for data collection is more feasible and can be easily adapted service different operations [2].

Currently many MCS applications have been developed including TSM (Transport System Monitoring), HM (Health Monitoring), TM (Traffic Monitoring). To date, many advanced smartphones are equipped with sensors capable of detecting velocity (accelerometer), light intensity (ambient light), image (camera), noise (microphone) and etc. Such ability to sense has transformed the smartphone into UMSD (Universal Mobile Sensing Devices) [3]. It is anticipated that in the future more sensors can be embedded in the smartphones because of the improvement to system-on-chip. Currently, modern smartphone e.g. Samsung Galaxy S6, is embedded with finger scanner and heart rate sensor.

Such ability to detect human attributes is quite effective to assist the user to monitor personal health and also can be used to improve security of data on the device. Table 1 shows various sensors in the smartphones, which can be used to determine different biological or non-biological information of an individual or even a community.

Table 1: Smartphone and built-in sensors

Sensor/Device	Samsung Galaxy S6	Samsung Galaxy S7	Nexus 6
Camera	✓	✓	✓
Microphone	✓	✓	✓
Accelerometer	✓	✓	✓
Digital Compass	✓	✓	✓
Light	✓	✓	na
Proximity	✓	✓	✓
Gyroscope	✓	✓	✓
Barometer	✓	✓	✓
Temperature	na	✓	na

1.1 Mobile Crowd Sensing (MCS)

In recent years, a new framework for mobile sensing has gained the consideration of the technical community [4]. In MCS, data can be shared among users. Such ability allows the MCS application to be used broadly to investigate a specific activities or parameters that is of interest within the community. The data can then be utilized by the relevant individuals or organizations to measure the peculiarities, which may affect a specific locality. Typically, the method employed by MCS is effective and the resultant outcome is quite reliable. In addition, employing MCS method is inexpensive because it removes the need to purchase, deploy and maintain permanent infrastructure.

The term MCS is created by "Ganti [5]" and have recently gained the attention of numerous researchers. Basically, this technology can be classified into two sets of technique i.e. PS (Participatory Sensing) and OS (Opportunistic Sensing) [6]. Each technique is distinguished by the employed sensing method. In PS the participants send data to the system leading to active outcome. On the contrary, in OP, the data is sent to the system with minimal user intervention.

1.2 Life Cycle of MCS Application

Typical lifecycle of MCS application is divided into 4 phases, which begins by application planning and end with data integrity verification [7].

1.2.1 Application Development

The system begins with requirement gathering related to the type of application to be developed. Information to be collected can vary from a simple survey to comprehensive observation of a specific condition of people behavior, traffic, weather and etc. Public sentiment extracted from social media may be also one of the methods, which can significantly provide essential information for application development. Once completed, the application is then deployed on the participants mobile.

1.2.2 Task Assignment

Once the application is successfully created, a rigorous testing is done to ensure the collected data is credible and will meet the objectives of the MCS application. Subsequent phase involves user selection and assignment of task to be conducted. Typically, minimal interaction between developer and user is required for application set up. Nonetheless, the developer of MCS application may need to ensure sufficient guide is provided to assist users and on the basic features to operate the application.

1.2.3 Task Completion

After the completion of task assignment, the primary duty of the MCS participants is to collect the data and ensure that the devices are consistently connected to the Internet. It is to enable periodic automated data upload to the server. To ensure randomness, no specific mobility pattern is needed to be adhered while gathering the data. However, critical information such as the GPS data from each mobile device is recorded and can be used to observe the movement pattern if required.

1.2.4 Data Incorporation

Every data collected by multiple participants is stored on centralized servers and undergoes various modification to change the data into a proper format the can be made useful for analysis [8]. The modification is a straightforward procedure, where data stored in a centralized server is queried and later multiple operations can be run to ensure the data is more reliable [9].

1.4 Issues with MCS Planners and Participants

During the entire process of MCS lifecycle, numerous issues may occur for the planners and participants. To ensure data collection is efficient, arising issues need to be resolved. To that end, the MCS activity can be successfully performed and achieved the set target.

1.4.1 Battery Drainage

Battery drainage is a typical issue directly related to the battery life of a user's smartphone. The issue mostly arises during the phase of task completion when the smartphone is required to sense, compute and upload the data. If the battery consumption is very high, it can discourage the participants and other users to take part in a MCS activity.

1.4.2 Smartphone Data Cost

Smartphone data cost is one of the major concerns because data upload services utilizes the user's Internet subscription i.e. data plan. Frequent data upload may adversely affect the user's mobile data usage. Therefore, it is essential that the primary requirement for user selection is the provision of sufficient data or Internet package.

1.4.3 Confidentiality

Confidentiality is also the pertaining issue in MCS application. The most significant factor that can affect user participation in the sensing activity is the readiness of user to share personal information. Much users are concerned that their activity may be tracked because personal information is shared with third-party application. However, such information sharing is quite typical in the current mobile technology. It is a fact that such practice is commonly employed by major mobile operating system companies and telecommunication service provider i.e. Google, Apple and Microsoft. Mobile users typically are unaware that these companies are constantly collecting data from the mobile users, especially user's local position information and call logs. Similarly, in MCS application a user have to agree to the location confidentiality because such activity requires the user to upload data using real locations. Nonetheless, a lack of proper security protection can cause serious data leakage and lead to personal data thefts, compromising user's confidential data. One of the solutions to mitigate the issue is to use the anonymization and mystification method. These methods can be added on MCS application to ensure the participant feel secure to share confidential information.

1.4.4 Benefits

The issues previously stated are some of the potential risks for users participating in MCS activity. However, it may be possible to alleviate the concern by providing the users with benefits for participating the MCS task. Basically, it is crucial that appropriate incentive is provided to users to motivate the participants and ensure the task assigned to them is properly performed. The benefits can be in the form of cash or other rewards e.g. free Internet plan.

1.4.5 Quality

The major objective of the MCS task planner is to set the quality of the task performed to gather the data. The quality of MCS task is measured based upon the nature of the sensing phenomena, which need to be measured. To improve the quality of the data it is pertinent that large number of participants should be employed to cover large geographical area. It also can ensure that the data collected is random and guarantee consistency.

1.5 Noise Pollution

Generally, the MCS application developed in this research work is to investigate the noise data around the vicinity of Kuala Lumpur and subsequently investigates the likelihood of noise pollution presence. Severe high level of noise emission may potentially lead to noise pollution. Noise pollution is fundamentally an upsetting or unnecessary phenomenon that may impact a person exposed to it. Moreover, noise pollution is a global issue that affect many countries and its residents. Overpopulated area, crowded cities, and poor city planning may have led to such problem. Consequently, many big cities have recorded several health-related cases e.g. hearing problems, aggressive behavior, insomnia, persistent stress, tiredness and hypertension. However, noise pollution may not have immediate impact to a person. The effect can transpire on the future generations and therefore, have long term implication to the social behavior.

Typically, the main source of noise pollution in any country is produced by the transportation system i.e. underground trains, trams and public transport. Other source of noise may also include heavy machineries on building construction sites, frequent social gathering places, and public event with loud music. The noises emitted particularly from such source can be irritating, causes bad effects on health and may even affect school children study performance.

The level of noise in which a typical person can tolerate varies. Table 2 shows the source of noise and the corresponding Sound Pressure Level (SPL) [10]. The pain threshold is the level at which the sound becomes painful for a person to hear.

Table 2: Noise sources and frequencies

Source/Observation Situation	Sound Pressure Level (SPL)
Hearing threshold	*0 dB*
Leaves fluttering	*20 dB*
Wisher in ear	*30 dB*
Normal speech conversation	*60 dB*
Vehicles for close observation	*60-100 dB*
Airplane taking off	*120 dB*
Pain threshold	*120-140 dB*

1.5.1 Noise Measurement

The unit to measure sound is decibel (dB). *Eq 1* is used to convert the data measured using a microphone into decibel (dB).

$$L_P = 20Log10(Amp) \qquad \ldots \qquad Eq\ (1)$$

Amp is the value of raw data measured using smartphone microphone using application [11], where the unit is Hertz (Hz).

$$L_{A-weighting} = \frac{10\log(1.56233f^4)}{(f^2+107.6525^2)(f^2+737.86223^2)} + \frac{10\log(2.242881 \times 10^{16}f^4)}{(f^2+20.598997^2)^2(f^2+12194.22^2)^2} \qquad \ldots$$

Eq (2)

1.5.2 Decibel Deduction

Human perceived and react differently to a variation of sound levels. Human ears are more sensitive to high-level sounds than the low-level sounds. When low level sound and high-level sound have the same intensity, it is deemed that high level sound are louder than low level sound. Therefore, the microphone used need to be calibrated to a proper sound levels to ensure the correct reaction to human ear is captured [12]. *Eq 2* is employed to calculate the value of A-weighting to cut-off the unwanted frequencies on the lower and upper band of human hearing.

1.6 International & Malaysia Regulations for Noise Pollution

Many countries have regulated the permitted noise level for a person, which not only limit the noise intensity but also the duration of exposure. In Malaysia, such law is enforced particularly at workplace. Industries are to adhere to “Minor Offences Ordinance, 1953”. This law bound everyone living in Malaysia to reduce the level of noise to a specific level after 11pm and it also enable the authorized law agency to impose such act. The Environment Quality Act 1974 is also in place, which has set specific condition, which when met is considered as noise pollution [13]. The Factories and Machinery (Noise Exposure) Guidelines 1989 by the Malaysian Government [14] has established the acceptable boundary of noise exposure as shown below:

a) Worker should not be exposed to the sound level above or constant sound level of 90 dB(A).
b) Worker should not be exposed to sound level above 115 dB(A) or above at any time of work.

Environment with minimal loud sounds is very pleasant to sustain and have less negative impact to the health of workers. Persistent sound level between 55 dB(A) and 65 dB(A) is considered as a level of concern for a person to be exposed. In the European community, as much as 40% of the population is exposed to transportation noise. It is equivalent to an A-weighting continuous sound level L_A exceeding 55dB daytime. In addition, 20% of the European population is exposed to the transportation noise exceeding 65dB. According to Berger in the report for World Health Organization (WHO) these sound levels are considered as either intrusive or annoying [15].
The Environment Quality (Act 1974) states that “No person shall, unless licensed, emit or cause or permit to emit any noise greater in volume, intensity or quality in contravention of the acceptable conditions”. As such, the person who violates the law may be imposed with severe fine or imprisonment or both. The established term “noise pollution” used in the context of Malaysian Noise Pollution Act generally corresponds to the references provided by Department of Environment (DOE) of Malaysia.

Despite the numerous regulations set to protect the Malaysian citizens from invasive sound levels, to date, only a handful of work has been done to study and monitor the noise data. The absence of sufficient noise data may be the reason many people are taking such issue for granted [16]. Based on the literature, some research work has been done to investigate the effect of noise to the community. It is deemed that consistent exposure to high level noise may cause a risk to the young generation [16]. Table 3 shows the noise level at different time of the day.

Table 3: Noise level during different time of day

Receiving Land Use Category	Day Time 7:00am–10:00pm	Night Time 10:00pm–7:00am
Noise Sensitive Areas, Low Density Residential, Institutional (School, Hospital), Worship Areas.	50 dB(A)	40 dB(A)
Suburban Residential (Medium Density) Areas, Public Spaces, Parks, Recreational Areas.	55 dB(A)	45 dB(A)
Urban Residential (High Density) Areas, Designated Mixed Development Areas (Residential–Commercial).	60 dB(A)	50 dB(A)
Commercial Business Zones.	65 dB(A)	55 dB(A)
Designated Industrial Zones.	70 dB(A)	60 dB(A)

In addition, the WHO also has recommended the levels of sound considered as tolerant to human health. The data is shown in Table 4 [15].

Table 4: Noise level safe for human beings

Environment	Critical Effect	Leq [dBA]	Time Base [h]	Lmax [dBA]
Bedroom	*Sleep disturbance*	*30*	*8*	*45*
Dwelling Room	*Speech interference*	*50*	*16*	*-*
Outdoor (day)	*Serious Annoyance*	*55*	*16*	*-*
School Classroom	*Speech interference*	*35*	*6*	*-*
School Courtyard	*Serious Annoyance*	*55*	*Play-time*	*-*
Hospital	*Sleep Disturbance*	*30*	*16*	*40*
Concert Hall	*Hearing Impairment*	*100*	*4*	*110*
Disco Headphones		*85*	*1*	*110*
Impulsive Sound	*Hearing deficits*	*-*	*-*	*140*

2. Methodology

In this research work, a new data gathering approach is introduced. The method is significant due to the efficiency to gather the data using MCS application, a set of 70 participants are randomly selected based on their location and daily movement pattern. The participants include taxi drivers, students and delivery person. The data is collected from the areas, which are designated under the administrative level of Kuala Lumpur city council. At the end of the data collection activity, an approximately 170 million records are gathered daily within the one-year period i.e. August 2016 until August 2017. In addition, the data is continuously collected between 12:00am and 11:59pm. Nonetheless, prior to analyses, the enormous amount of raw data needs to be cleansed to produce a practicable output. It is observed that the results obtained from the MCS experiment are also reasonably credible due to the fact that the noise data sample is taken periodically over long period of time. Figure 1 shows the area name and the corresponding number on the map. The area name, which are selected to collect the data are as shown below:

1. Bukit Bintang
2. Titiwangsa
3. Setiawangsa
4. Wangsa Maju
5. Batu
6. Kepong
7. Segambut
8. Lembah Pantai
9. Seputeh
10. Bandar Tun Razak
11. Cheras

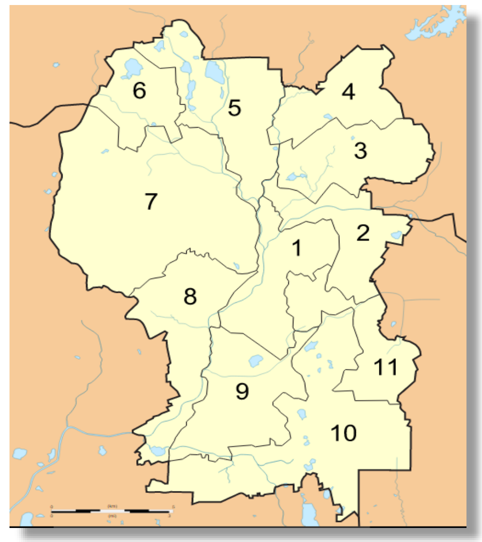

Figure 1: Area in Kuala Lumpur

2.1 Data Analysis

The analysis of data is typically done on the server side rather than locally on the smartphone. The processing power available on phone is substantially limited and does not have sufficient resources to perform the task. Therefore, the data of noise recorded by the smartphones is send to the server-side application for examination using Application Programming Inferface (API). After transmission, data is relayed to a database, where later another process is run to extract the frequencies from the raw data. The abstract values are then converted to decibel using the *Eq 1*. Then, *Eq. 2* is employed to obtain the A-weighting based value. The final step in the data analysis process is to validate the output against the calibrated values of each smartphone device. Some microphones built into the device is manufactured by different company and therefore it is imperative that the computed result is compared against the sound value collected by an industry-standard digital sound level meter. The discussion of the validation and the method to evaluate the result are explained in the next section. In principle, three (3) parameters are examined i.e. noise level (dBA), location of noise source (latitude, longitude) and time of day when the value is recorded.

2.2 Results Evaluation

One of the issue of data collection using MCS application is the accuracy of the raw data obtained using smartphone's microphone. Nonetheless, such shortcoming can be mitigated by two methods. First by correcting the hardware differences between various smartphone. This can be done by validating output from the smartphones against the output obtained from commercial digital sound meter. Secondly by ensuring each microphone used in the smartphone possesses similar specification to each other. In this research work, the concern on data accuracy is eliminated by using the second method, where data from smartphones is validated against the calibrated standard equipment i.e. digital sound meter. Based on the result of data comparison, the association between raw data can be investigated. Different model of android smartphones is used for the validation purpose, which include Samsung, LG, Nexus, Hawaii, and HTC. After performing the validation experiment, the differences obtained is shown in Table 5.

Table 5: Calibration of smartphone microphone input

Smartphone Name	a	b
SAMSUNG	1.17	-1.95
HTC	1.45	2.46
NEXUS	1.89	5.55
LG	1.39	-4.36
Huawei	1.78	-9.56

The differences in data value measured by using smartphone microphone and commercial sound meter are quite distinctive. It is because the microphone sensors can only detect noises based upon the diaphragm of the device. On the other hand, commercial sound meters only require relatively small sound waves to vibrate and reach to large trembling amplitude. As such, the sensors embedded in the smartphones are unable to properly measured the correct noise value as compared to the commercial digital sound meter. An investigative experiment is specifically conducted to determine the lower (*a*) and upper (*b*) bound frequencies and the associated A-weighting value. As shown by Table 5, the constant a and b corresponds to the differences between noise measured from smartphone's microphone as compared the sound meter device. The a is the recorded noise value measured on the minimum end frequency spectrum, while b is on the maximum.

Nevertheless, upon investigation and comparing the values collected from smartphone's microphone and the digital sound meter, it is deemed that both measured noises does not have direct association to each other. Therefore, the differences of measured value between the two devices i.e. smartphone's microphone and sound meter can be reduced using the constant value *a* and *b* as shown by Table 5. However, the sound level varieties of smartphone are not as extensive as of digital noise meter. The difference of value between different models of same company can be further reduced by employing smartphones, which are equipped with similar microphone specification.

2.3 Noise Level and Data Calibration

The noise data at each area is taken within 24 hours, each day. It follows the participant's daily routine, where the MCS application remained discreetly operated. As previously stated, each recorded noise data is processed on the server side. *Eq (1)* is employed to convert the raw noise data collected from the microphone into dB (decibel), which is the standard unit used to calculate a noise level. Later the A-weighting value i.e. $L_{A-weighting}$, is computed using *Eq (2)*. Basically, the $L_{A-weighting}$ is one of the frequency weightings typically used to remove the undesirable frequencies at the lower and higher end, where an average person unable hear. $L_{A-weighting}$ shown in *Eq(3)* is used to identify the A-weighting values and to convert the noise data into a standard unit used for noise pollution computation. Nonetheless, prior to the A-weighting computation, the noise data (*dB*) from *Eq (1)* need to be calibrated to ensure credibility of noise output. Therefore, *Eq (4)* is used, which will calculate the level of noise that is appropriate with human hearing level i.e. unit is in *dBA*. The mathematical calculation follows the computation in [17]. The Noise Level (NL_{dBA}) shown by *Eq (4)* is then used to remove the errors due to response of smartphone's microphone to noise. This is to ensure that the noise level recorded by the microphone is comparable to the noise output by the digital sound meter. The result is shown by Table 6.

$$L_{A-weighting} = L_P - (A - weighting) \ldots \qquad Eq\ (3)$$

$$NL_{dBA} = L_{A-weighting} + aL_P + b \qquad \ldots \qquad Eq\ (4)$$

L_A is the calculated noise level in *dBA*, a unit that is commonly used to calculate the noise level for an average person? L_P is the original noise level converted into dB using the *Eq(1)*.

Table 6: A-weightage values to numerous frequencies

Frequency (Hz)	A-weighting (dB)
42	*-33.5*
53	*-30.2*
60	*-27.1*
79	*-22.5*
102	*-18.5*
127	*-12.5*
155	*-11.2*
195	*-9.9*
235	*-8.2*
320	*-5.9*
401	*-4.5*

Upon converting the values using *Eq (4)*, the data is then calibrated based on the calculated value shown in Table 5. The *a* and *b* value correspond to different specification and model of the smartphone and as such, the noise output after calibration will likely to match the measured noise level obtained from commercial digital sound meter. Consequently the L_A is the final value that can be used to show the level of noise collected using the smartphone sensors.

3. Results and Analysis

The section discusses the information collected related to noise levels in different areas of Kuala Lumpur. As previously stated, the final noise value is processed through the *Eq (1)* through *Eq (4)*.

3.1 Geographical Data Representation

The geographical representation of the collected data is shown in the areas within Kuala Lumpur. The range of noise data gathered in 24 hours each day is between 25 to 90 dBA.

Figure 2 shows the noise level for 24 hours on 1 February 2017 in Kuala Lumpur, which was the public holiday. Kuala Lumpur is divided into 11 sub divisions and each area is plotted with three distinguish colors. Dark green, corresponds to safe noise level i.e. below 40dB, while light green indicates the level of noise that is neither in safe level nor in danger zone below 60 dB during most of the time. And the red colour dots show the level of noise not in safe zone, where noise value is consistently above 60 dB. Based on Figure 2, it is observed that much of the areas in KL is quite safe and the number of green spots dominates the reds. One of the reasons could be due to less traffic activity on roads.

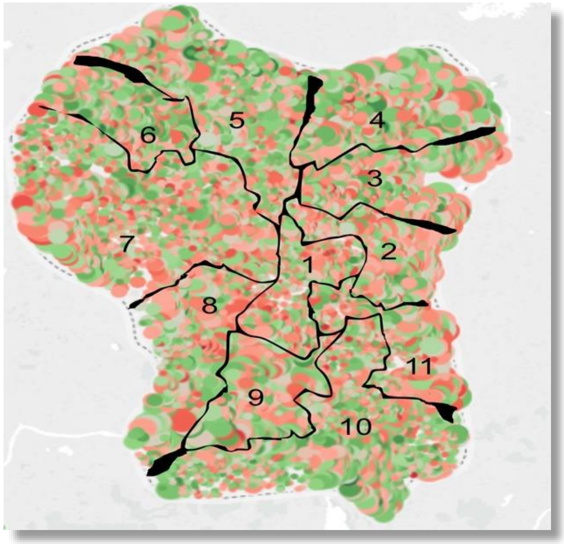

Figure 2: Noise data on public holiday

Figure 3 shows the noise level for 24 hours on 16 February 2017 in Kuala Lumpur which is a normal working day. In contrast, the red spots are more prominent and scattered throughout all major towns in Kuala Lumpur. The result is expected because many people spend much of their time outside their home for travel to workplace.

Figure 4 shows the noise level for 24 hours on 19 February 2017 in Kuala Lumpur which is a weekend day. The number of spots is less as compared to Figure 2 and Figure 4. It indicates a significantly less activity on weekend despite the presence of several red spots in several areas. Although Figure 2 and Figure 4 have less red spots as compared to Figure 3, it is observed that there are more unfilled areas, which is a sign of inactivity. However, such situation is not manifested during public holiday. One of the reasons may be because people tends to spend time out on public holiday to attend events and as such, the number of spots is generally higher.

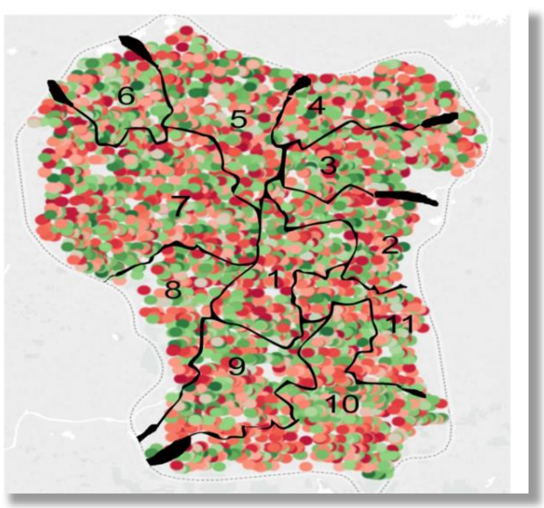

Figure 3: Noise data on weekdays

Figure 4: Noise data on weekend

Figure 2 through Figure 4 show that the data collected on various days i.e. weekdays, weekends, and public holiday. As expected, the data concentration is substantially high on public holiday and weekdays, but the noise level is quite low on public holidays. However, it is quite apparent that the exposure to noise pollution on weekdays is severe to many people on certain area. As previously stated, the maximum noise level set by DOE of Malaysia in urban and suburban, is 55dBA during daytime (7 am to 10 pm) and 30dBA during night (10 pm to 7 am). This shows that noise level in all areas exceeded in all the areas of KL during different time of day.

3.2 Conventional and MCS Based Data Collection Method

To assess the impact of noise pollution to citizens, the conventional method is still the preferred choice because of the accuracy that such method can provide. To date, the MCS application has become more popular to gather information in a scope of areas that is particularly large. However, there are some concern that could deter the MCS implementation and these includes expensive instrument, expert peoples and proper environment.

In the conventional method, the organization or a group of people that is interested to study a particular issue in the society need to ensure proper instruments and trained peoples are available to handle the project. Special survey may be required to identify the places where instruments need to be installed. Furthermore, additional cost may be required to install and maintain the equipment's. Upon establishment of the infrastructure, the data collected from the sensors are to be gathered in the server for analysis. Information acquired from the sensors are raw and therefore, data analytics need to be performed to identify the feasible data for the experiment conducted. The MCS system also need to consider the ability of the sensors to detect and extract the relevant information.

Indeed, the crowd sensing technique using smartphones has become inherently common in many survey works, which require data collection using distributive method. The approach can be effective because the amount of data collected can be enormous covering large geographical area. Nonetheless, the advancement of mobile technology has helped the fact that the MCS application can be a practicable method to conduct experiment. In addition, the simplest MCS based applications only require minimal equipment to set up i.e. smartphone with equipped sensors and a person to start application and application to detect the issue. There is less need for complex equipment to be established. As such, the MCS application is able to offer cost effective option to the centralized method.

4. Conclusions and Future Work

The results discussed in section 3 shows that most of the areas in Kuala Lumpur are not safe to live during certain period time of the day. It is because the level of noise pollution is high, and many people may be frequently exposed to long term high pitching noise. The conventional noise pollution computation method is not effective due to the fact that such method requires high resource to be implemented. Despite the advantage it provides, it is essential to ensure that the employed MCS application is accurate. In this research work, two issues are addressed particularly on the data collection mechanism. Firstly, the difference of values between the data collected using smartphone and digital sound meter. Second, the difference of value between data collected using different smartphones by different companies. In this paper, a noise pollution MCS application is developed to assess the level of noise in Kuala Lumpur. The proposed application is generic and can be used on other MCS application to collect different environment parameters. In future new features will be added in the application and different phenomena were tested for the betterment of human beings.

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