



1 **Applying IT Communication Technology in Public Awareness**
2 **and Education for Reducing Hazard Casualty in South East**
3 **Asia Developing Countries**

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12 **Abstract.** In developing countries, especially most of South East Asia countries, every year landslides,
13 mudslides and flood occur during monsoon rainy season and cause casualties not only in rural areas, but also in
14 urban areas. Public awareness and education activities are important to reduce the casualties of such natural
15 disasters. Nowadays, IT communication technology plays an important role in disseminating information and
16 education. Lately, applying IT communication technology for public awareness on natural hazard becomes a
17 trend among government authorities in these countries.

18 We begin our study in Malaysia on how to reduce landslides casualty for future natural hazard management in
19 these developing countries. For a better understanding on the occurrence of landslides, besides the mechanism on
20 how landslides occur, collecting historical data with location coordinates were carried out and stored in database
21 periodically. Public can browse these historical data via internet and know which areas are more prone to
22 landslides occurrence.

23 At the same time, IT communication technology was used to disseminate alert information after receiving
24 rainfall intensity data from the monitoring sites. It was also more efficient to conduct the public and school
25 children awareness education by using such technology, as the simulation of rainfall induced slope failure
26 mechanism and educational video on symptoms of landslides before they occur may give a clearer picture and
27 better understanding to the public and school children.



1 **1 Introduction**

2 Every year, the Northeast Monsoon brings heavy rain to the East Coast of Peninsular Malaysia from November
3 to March. In 2014, heavy rain (recorded 890mm rainfall from 19th. December, 2014 to 27th. December, 2014)
4 caused flood and landslides along the East Coast of Peninsular Malaysia. The East-west Highway (Federal Route
5 4) in Malaysia was cut off due to slope failures on 23rd. December, 2014 as shown in Fig. 1. It caused casualties
6 and billion of Malaysian Ringgit economical losses. Moreover, according to the news, in 2015, besides the 3
7 large scale landslides that happened in Malaysia, landslides were also reported in Philippines(2), Indonesia(3),
8 Thailand(1), Myanmar(1) and Vietnam(2).

9 In July 2015, the City Hall of Kuala Lumpur pointed out that there are more than 600 slopes which are classified
10 as high risk slopes, after conducting sites survey in Kuala Lumpur, with the Public Works Institutes of Malaysia.
11 Therefore, to reduce the occurrence of casualty, the public awareness and education on natural hazard should be
12 given priority.

13 In Motoya, E. et al. (2015) study, they only carried out crowdsourcing study for community mapping towards
14 public awareness and preparedness on the disaster occurrence, mainly slope failure. Ahmad, J. and Lateh, H.
15 (2015) discussed on how important the role of teachers in educating students on the risk of landslides disaster in
16 rural and urban areas.

17 Here, besides introducing how IT technology was used to disseminate early warning information, landslides
18 education workshops in primary schools were conducted to provide students with a better understanding on
19 natural hazard, for reducing natural disaster casualty.

20 **2 IT technology in collecting monitoring data and disseminating early warning information**

21 Most of slope failures in South East Asia occurred after heavy rain. Rainfall was the main factor that induced
22 landslides. Slope failures were also caused by unplanned development of hilly areas which made way for
23 housing projects due to the ever growing population in the cities in these fast growing countries. Therefore, a
24 good monitoring system such as the tipping bucket rain gauge installation is needed to monitor the high risk
25 slopes. In our study, we installed 2 main monitoring systems along the East-west Highway, Malaysia where the
26 locations are N05 ° 32.918' E101 ° 20.749' and N05 ° 36.042' E101 ° 35.546'. The collected number of tipping
27 times from the sites are sent to the monitoring server and converted to rainfall intensity value by multiplying
28 0.5mm.

29 In our study on landslide prediction, if the curve in the accumulated rainfall vs rainfall intensity graph crosses
30 over the cautious and critical lines, Koay, S. P. et al. (2013), as shown in Fig. 2, the alert message will be sent to
31 the pre-registered and authorized users for early warning dissemination purpose via email and SMS to mobile
32 phone as in Fig. 3.



1 The cautious and critical lines were generated by the simulator, Koay, S. P. et al.(2008), with the condition of the
2 slope angle $> 33^\circ$, and the soil properties: cohesion $C_a = 25\text{g/cm}^2$, effective porosity / valid porosity $\lambda = 0.4$,
3 saturated hydraulic conductivity $K = 0.02\text{ m/h}$, internal friction angle $\Phi = 35^\circ$ and soil unit weight $\gamma_s = 1.36$
4 g/cm^3 Unlike developed countries, at present, there is not enough rainfall-induced historical landslides data to
5 create the cautious and critical lines to predict slope failure, in Malaysia. These lines will be continuously
6 calibrated with the real rainfall data that triggered the landslides.

7 **3 Natural hazard historical information and education for public awareness**

8 Well-designed early warning system is not enough to reduce casualties. Public awareness on natural hazard is
9 also very important to avoid casualties. More information on natural hazard historical occurrence venue (Fig. 4),
10 knowledge on the mechanism and symptoms of landslides occurrence, and hazard map for preparedness of
11 evacuation to shelter (Fig. 5) if natural hazard occurs, via internet, are needed for gaining the public awareness.

12 The well-informed and well-prepared public will not panic when confronting the natural hazards. During 2011
13 Tohoku Earthquake and Tsunami Disaster, Iwate Prefecture has less number of mortality compared to Miyagi
14 Prefecture as Iwate Prefecture local government practised more public awareness education and evacuation
15 training in schools, according to past disaster experiences, Hayashi H. (2015). Therefore, education and learning
16 on how to obtain the natural hazard information should be practiced since childhood. Promoting natural hazard
17 education, through games, for school children learning in primary school curriculum is recommended, especially
18 where the schools are located in the hilly area. Besides showing the slides or videos on natural disaster, hands-on
19 education should be conducted in schools as Koay, S. P. et al. (2015).

20 Mixed terminology can confuse the public, while too many technical words, jargons, or scientific language is
21 unhelpful for those who do not know much about geological hazards, Gill, J. et al.(2015), in the primary school
22 natural hazard education. Using simple terms may give school children a better understanding, as the main
23 purpose of the education is to teach the students.

24 A natural hazard education workshop was conducted on 7th April, 2015 in a school, SK RPS Banun, in rural
25 area. Most of the students are aborigines Jahai, Negrito tribe. Later on 12th October, 2015 and 2nd November,
26 2015, we conducted 2 more workshops in schools in urban area. One is SJKC Perempuan China, where the
27 students are good in Chinese language and the other is SJK Minden Height, where the students understand
28 Malay language well. Before starting the explanation on landslides, questionnaires on landslides knowledge and
29 weather station were given to the students to answer. Less than 5% students managed to give the right
30 answer in the rural area while more than 78% students from the urban area gave the correct answer. None of the students
31 from SK RPS Banun could understand the high risk of landslides road signboard with only the simple landslides
32 symbol. However, after showing them the photo of the signboard with slope failure at the back, all the students
33 could answer. It is clear that the signboard photos with the slope failure as background, provides a better
34 understanding.



1 From our questionnaire survey, most of the school students in the urban area have knowledge on how and why
2 natural hazard happens before conducting education workshop compared to the rural area students. However,
3 after attending 30 minutes of simple slides show on what would happen after heavy rain in the hilly area,
4 landslides symptom by comparing the colour of spring water from the soil in the slope in two videos Koay, S. P.
5 et al. (2015) as Fig. 6, slope failure mechanism, and hands-on weather station experiments as Fig. 7, the school
6 students in the rural area gave right answers to the questions and understood the functions of a weather station
7 well in the post education workshop questionnaire. Moreover, after taking the natural hazard class, all of the
8 students from rural and urban areas, were more alert of the natural hazards in their surroundings. This natural
9 hazard education workshop managed to attract the students' attention. They are more prepared to face the natural
10 hazards now and also looking forward to learning more on natural hazards in the future.

11 We also concluded that it is important to use the students' mother tongue or first language to conduct the
12 workshop, especially in primary schools, for providing a better picture to the students after conducting the
13 workshop in SJKC Perempuan China by using the Malay language, where most of the students could not
14 understand well in the Malay language even though it is national official language in Malaysia, as shown Table
15 1. In most of the South East Asia countries, there are many races who speak their own languages when at home.
16 We should be aware of the language while conducting education workshop in primary schools in these
17 developing countries.

18 **4 Conclusions**

19 IT communication technology plays a major role in predicting the occurrence of landslides and disseminating
20 information to the public at the right time and the exact venue. It is more effective to conduct school children
21 education on natural hazard by using IT technology. Choosing the right mother tongue or first language and
22 using simple terms to explain to the students are very important for better understanding when conducting
23 natural hazard education in primary schools in developing countries where there are many races. Education on
24 natural hazard should be conducted in schools, especially in lakeside, riverside and hilly areas. Learning natural
25 hazard by playing games and hands-on experiment may attract students' attention in the primary schools.

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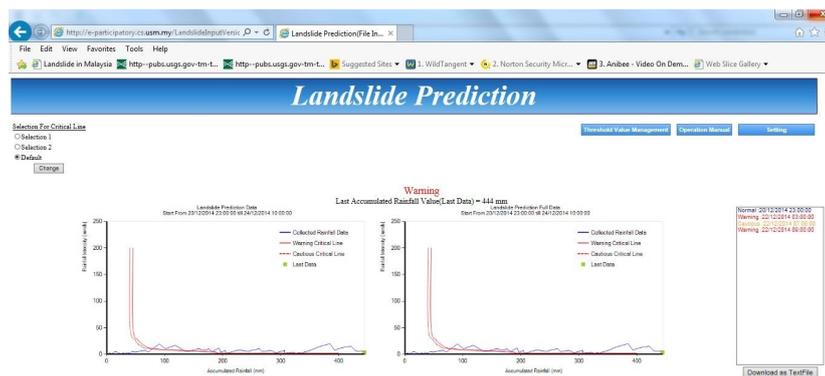


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Figure 1. Landslides that happened in the East-west Highway on 23rd Dec., 2014.



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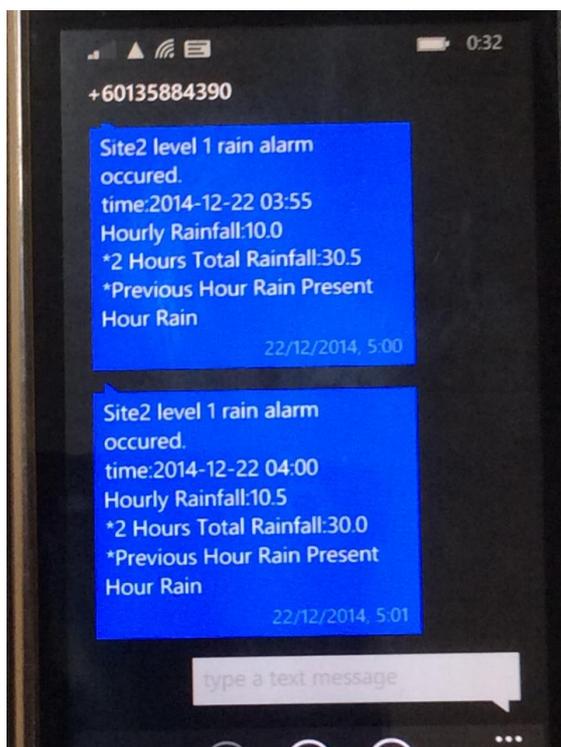
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3 Figure 2. Landslide prediction showing the East-west Highway was at high risk on 22nd. Dec., 2014.

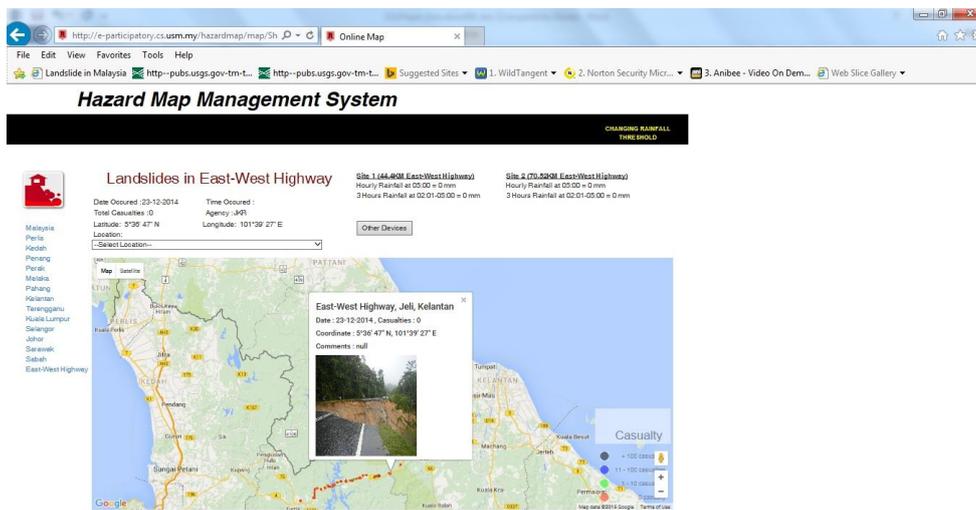
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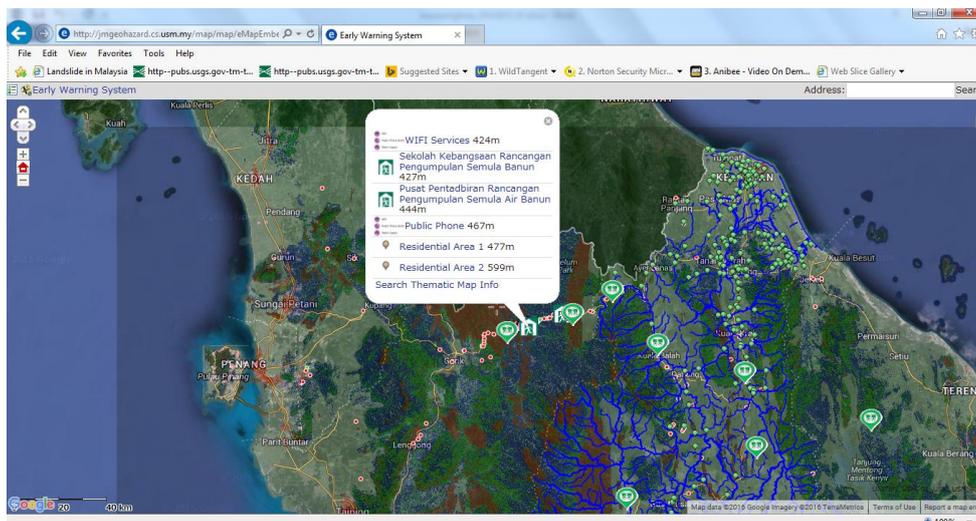


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2 Figure 3. Alert message was sent to the registered user via SMS.
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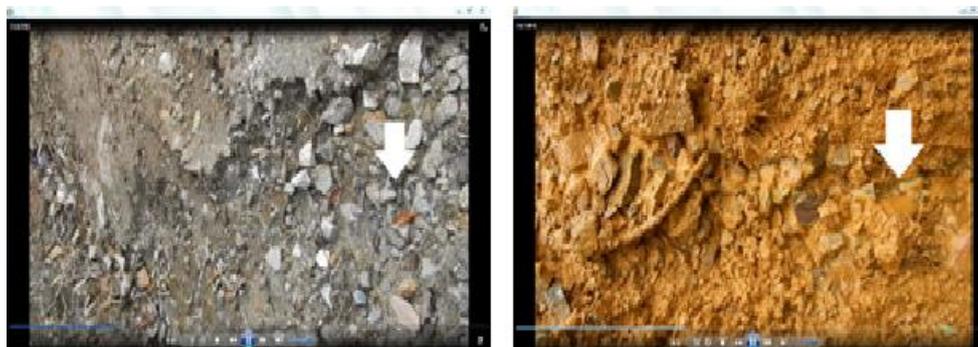
Figure 4. Historical data providing natural hazard information on a hazard map.



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2 Figure 5. Hazard map for evacuation to shelter along East-west Highway.

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- 2 Figure 6. Video showing a sound slope with pure spring water and a slope at high risk with impure spring water
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2 Figure 7. Hands-on education on weather station.
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1

Number of correct answers to questions on the function of a Weather Station			
	SK RPS Banun(school in rural area) (Malay Language)	SJKC Perempuan Cina(school in urban area) (Chinese Language)	SJK Minden Height(school in urban area) (Malay Language)
Before Explanation(in Malay Language)	1 correct (out of 50 students)	39 correct (out of 50 students)	47 correct (out of 50 students)
After Explanation(in Malay Language)	43 correct (out of 50 students)	42 correct (out of 50 students)	48 correct (out of 50 students)

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Table 1. Result of answering same question before and after education.