A space-based solution for earth observation: technology transfer and building user groups of user-friendly satellite data

Advisors

Assoc.Prof. M.L. Siripastr Jayanta, Chulalongkorn University
Assoc.Prof. Dr. Numpon Insin, Chulalongkorn University

Team members

Kevin Yuen 6238007823
Narutchai Arunrattananukul 6238028023
Proud Prakopvitayakit 6238032423
Tanatat Techadilok 6238023823
Teerasit Saweephanlop 6238026723
Thitaporn Petchpadoong 6238014123

Sponsor

The Club of Recipients of Ananda Mahidol Foundation
Mae Ping National Park
Prime Minister's Delivery Unit

Abstract

The northern region of Thailand has been afflicted by smoke due to forest burning concerns in many places, affecting villagers in the community as a result of this conduct. From these problems above, we designed a study with the goal to reduce the burning area of forests through the means of a fire tracking website by (1) teaching students between the ages of 11 and 14 years old how to use the website and testing their effectiveness (2) teaching youth in areas about fire maps and how to draw them, (3) conducting a survey with users about their experiences with the site to compile a recommendation report for website developers, and (4) cultivating and sustaining ideas of protecting forests from fires. The result of our teaching gave mixed results compared to our passing criteria of 75%. For the creation of a sustainable project, our team has consulted with Mae Ping National Park officials and came up with an idea to implement the "Students tour guide" project. We also have some suggestions for those who will continue this project to cultivate the TamFire website into the future.

An Interactive Social Science Project submitted to the Faculty of science chula university in partial fulfillment of the requirements for the Degree of Bachelor of Science

Introduction

Nature is the sole reason for the existence of humans to this day, and yet it is still being neglected in many ways. Forests, for example, are a great source of natural resources due to their high amount of biodiversity, which offers medicinal, agricultural, and industrial uses. However, these forest areas are being destroyed by man-made forest fires, which reduce the amount of forest land and biodiversity of the forest. These forest fires have massive repercussions on Earth as it contributes to the ever-increasing danger of climate change.

There are many reasons that explain why these forest fires happen. As the agricultural business grows, so does the amount of land required for farmland. Farmers usually are financially poor, which means they would usually use the cheapest way to clear massive amounts of forest land. Not only does the burning of the forest cause many plants to be destroyed, but animals are also losing their lives to the fire as a result of losing their homes and food source. The fire also releases a high number of pollutants into the atmosphere, which poses a danger to people who live around the area.

In Thailand, there are a substantial amount of forest fires every day, most of which are concentrated in the northern parts of Thailand, around Chiang Mai. In September of 2021, 84,417.69 rai, or 135 million square meters of forest land, was burned in the northern parts of Thailand alone.

According to the data from the Department of National Parks and the Wildlife and Plant Conservation, there were approximately 255 forest fires that were put out by the staff in Mae Ping National Park in Lamphun province. This number of fires is among the highest number of fires reported in Thailand, which makes Mae Ping National Park the ideal model to follow in terms of fire control (Ban Kor sandbox).

As a response, our sponsor has come up with an application called TamFire to combat forest fire.

The purpose of this application is to allow locals to get real-time monitoring reports of the fire, predict the fire direction so that they can put right preventive measures, and lastly, let the user assess the fire damage and identify fire habits of the villagers. To help with this, support groups are needed to go to the areas where the locals live to not only help the locals understand and use the TamFire application effectively but also to set up the locals to be self-sufficient enough to pass on the knowledge to future generations.

The purpose of the TamFire project is to properly integrate the TamFire application into the locals' everyday lives, with the main target being children. This would be done with the usage of activities and educational videos. Once the locals are able to use the application on their own, a program would be set up to allow them to help educate others without any external help. By doing it in this way, the locals would then be able to use the TamFire application as though it is a part of their everyday lives.

Background

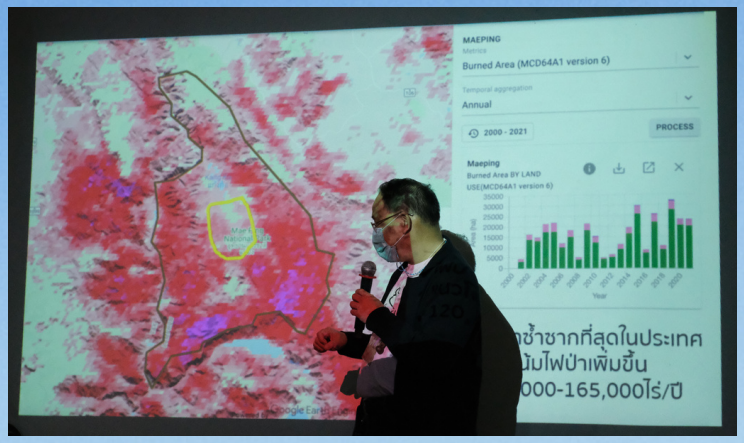
Stakeholders

2.1.1 The Club of Recipients of Ananda Mahidol Foundation

The Ananda Mahidol Foundation was founded by His Majesty King Bhumibol Adulyadej. King Bhumibol realized that the Kingdom needed experts from high-level academics. Thus, His Majesty supported those that displayed extraordinary academic capabilities to enable them to study on an advanced level abroad and serve the country when they return from abroad. With this in mind, His Majesty ordered the founding of the Ananda Mahidol Foundation as “Ananda Mahidol Scholarship” in its experimental stage in 1955.

2.1.2 Mae Ping National Park

The Ban Kor village is located in the Mae Ping National Park in Thailand's northern area, where wildfires erupt in the surrounding forests many times a year. Mae Ping National Park was established in 1980 as Thailand's thirty-second national park, covering over 1,000 square kilometers and extending across Chiang Mai's Doi Tao District, Lamphun's Li District, and Tak's Sam Ngao District. The landscape of Mae Ping National Park is mostly mountainous. The mountain range runs from the north side, in the Doi Tao district, to the south side, around the northern part of Bhumibol Dam. Ban Kor is a village located in a flat area surrounded by mountains.



2.1.3 Prime Minister's Delivery Unit

This is a non-government institution of the Prime Minister's Secretariat with the main mission to support the government. They carry out strategic and integrated missions by solving problems for people who are not able to follow the bureaucratic system or experience delays from which damage may arise if left unsolved for too long. Hence, the work of PMDU emphasizes increasing the integration work between agencies to accelerate and keep track of the progression of government agencies. Moreover, PMDU took part in developing the Ban Kor SandBox project by providing financial support.

2.1.4 Harn Engineering Solutions Public Company Limited

Harn Engineering Solutions Public Company Limited (HARN) completed the transfer of its whole business to Chillmatch and Q II S Company Limited. All three companies were previously part of Harn Engineering Co., Ltd, which had pioneered refrigeration distributorship and consultation since 1965 before they spun off to focus on their own market niche. HARN is committed to being a supplier of leading sustainable solutions of engineering systems in the areas of safety, refrigeration, and digital printing in Thailand and neighboring countries.

2.1.5 CU SENSE, Faculty of Engineering

Chulalongkorn University: Chulalongkorn University's Faculty of Engineering has established cusense.net, a website that provides data for air quality monitoring around Thailand4. During the PM 2.5 crisis in early 2021, the website served as a resource for monitoring air quality. The faculty has also teamed with CAT Telecom to use Twitter to distribute air quality reports. The information received comes from air pollution sensors in Nan province and various parts of Bangkok.

Sponsorship mission and previous accomplishment

2 2.2.1 Ban Kor sandbox

2.2.1 Ban Kor sandbox

Dr. Jain Charnnarong, the director of HARN and the president of The Club of Recipients of Ananda Mahidol Foundation, has enlisted the help of their disciples from many branches in an attempt to solve the PM 2.5 and smoke dust situation in Northern Thailand, starting from the Ban Kor area within Mae Ping National Park of Lamphun Province, designated as “Ban Kor sandbox” in 2019. The installment of a PM 2.5 detector in Ban Kor School, which has assisted in creating an understanding of air pollution health hazards for villagers, has proven to be effective at improving the villagers’ quality of life with a statistical reduction of 39% of wildfires reported in the Mae Ping National Park in 20205.

2.2.1.1 Goals

The goal of “Ban Kor sandbox” is to improve the quality of life for people living in Ban Kor by solving the local wildfire situation and reduce poverty by promoting agricultural, fishery, soil, and water resource management along with tourism and education that are harmed by wildfire effects. For the villagers to stop burning and damaging the forest, they must have a way to find food, water, and other life necessities to fulfill their lives, thus having no need to destroy the forest in order to sustain themselves. This is the goal of the “Ban Kor sandbox” - to address these issues by promoting agricultural, fisheries, soil, and water resource management through tourism and education.

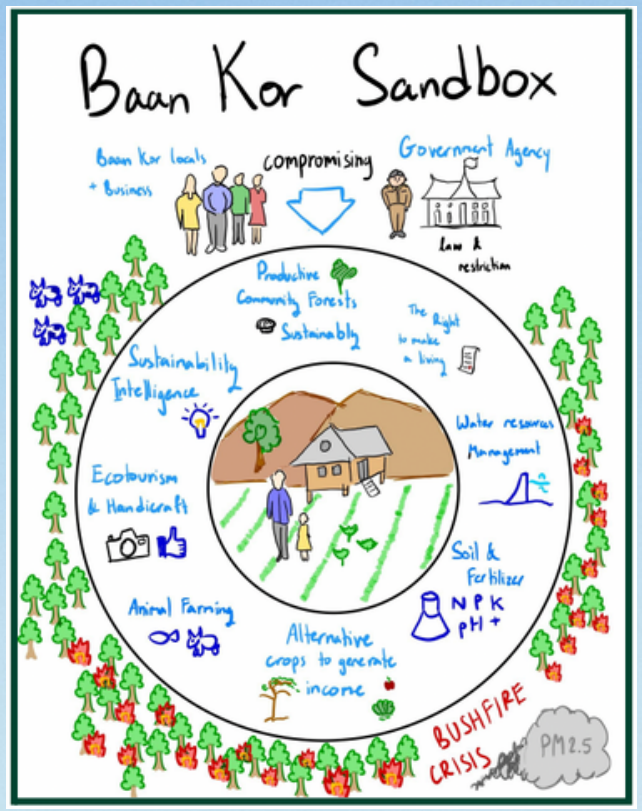


Figure 1: The Ban Kor Sandbox developed by Dr. Jain Charnnarong, the recipient of the Ananda Mahidol Award

TamFire, the web-based application designed for the monitoring of hotspots

2.3.1 Overview of TamFire.net

TamFire.net is one of the innovative instruments that was a result of government collaboration. The heat point data from satellites are brought to educational institutions, public society, and businesses. It was shown as a wildfire map, allowing anyone interested in fire behavior to evaluate it. The goal is not just to preserve the forest but also to aid in the reduction of PM 2.5 dust.

The “TamFire” website shows the hotspots and other information regarding the fire. The application would be useful for everyone, especially young groups, to participate in the analysis of the location and movement of forest fires in the villages, take preparation to prevent a repeat of the same fire in the next season, and create well-known websites.

The TamFire website is another example of diverse sectors working together to maintain the natural balance and address the PM 2.5 pollution problem, which is a national priority agenda that no single group or agency would be able to address satisfactorily. They won't be able to do it all by themselves; they would need the help of everyone in society. In the future, this will be the most essential technique for combating forest fires in all seasons.

2.3.2 How TamFire.net works

In essence, the TamFire website is comparable to the "US Wildfires – Disaster Response Program" by using a satellite as a virtual "Bird’s-eye view" that orbits the Earth and picks up heat spots on the Earth's surface and can categorize the source of burnt area. This is critical information for managing wildfires and ensuring that people are informed of the risks as soon as possible and reducing the number of people killed or injured, as well as pollutants in the air. Image data from four Earth-orbiting satellites are combined on the "TamFire" website (Terra, Aqua, NOAA-20, and Suomi NPP satellites). The heat detectors on the satellite are the Visible Infrared Imaging Radiometer Suite (VIIRS) and the Moderate Resolution Imaging Spectroradiometer (MODIS). They can detect heat radiation from areas on the Earth's surface that are barely 15 degrees Celsius above the surrounding environment with a picture width ranging from 2,330 to 3,060 kilometers. Therefore, it is possible to say if a fire is burning in the open or a forest fire is raging in any part of the country. The technology would detect it. The system processes the hot spot in three hours and promptly publishes it on the website.

Model application designed for the monitoring of hotspots

2.4.1 Idaho fire map

During the wildfire season, this website provides interactive data for air quality forecasts. Situational awareness of fire locations, fire thermal output, fire perimeters, and incident information are provided by maps, dashboards, and linkages. Satellite imaging depicts smoke position and movement in near-real-time (NRT) and real-time (RT). A meteorological map depicts the present weather conditions in the atmosphere. Aerosol and trace gas fire emissions from satellite retrievals are visualized on maps. Maps, charts, and links provide access to data from air quality monitors that convey pollution concentrations on the ground. Future simulated air quality conditions are shown using a range of relevant smoke and air quality forecast models.

2.4.2 Forest fire risk forecasting in the northern region of Thailand by GISTDA

In mountainous and agricultural areas, forest fires are common and are a result of many different issues. During the months of January to May, the ten provinces in Thailand's upper north region are specially designated as vulnerable areas of recurring hotspots and smoke plumes. To solve this, the identification of hotspots must be located so there can be better forecasting for forest fires in the future. The article from GISTDA talks about using and testing combined data and information to find the hot spot of the fire in the test area by utilizing satellite image processing and GIS-based environment8.

2.4.3 The disaster response program

The Disaster Response Program (DRS) is a website designed by Esri to aid rescue groups in responding to a wide range of catastrophes and crises around the world by utilizing geographic information system technologies to detect emerging problems. Using MODIS and VIIRS satellites to detect hotspots throughout the world, the DRS wildfire map gives information about wildfires occurring around the world.

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2.4.4 AirNow

AirNow is your one-stop source for air quality data which highlights air quality in local areas first while still providing air quality information at the state, national, and world views with an interactive map. AirNow reports air quality using the official U.S. Air Quality Index (AQI), a color-coded index designed to communicate whether air quality is healthy or unhealthy.

2.4.5 NASA FIRMS

FIRMS uses a wide range of NASA Earth observation and derived scientific data products to detect the location and extent of fire activity, as well as its effects on the land and atmosphere, in near-real-time. To better address the needs and use cases of varied users, FIRMS recently created a scalable user interface. The user interface at the right side of the map window defaults to BASIC MODE when you start the fire map for either FIRMS Global or FIRMS US/Canada. This mode includes active fire-detection data from VIIRS, locations of current significant wildland fires in the United States and Canada, true-color MODIS and VIIRS satellite imagery, and specific backdrop and overlay layers.

By selecting the button, users can switch to ADVANCED MODE. Users can access and view all accessible FIRMS layers in this mode. False color MODIS and VIIRS satellite images, MODIS and VIIRS land and atmosphere research data packages, other satellite imagery sources, wildland fire management contextual layers, and many overlay and background layers are included.

2.4.6 Smoke Watch

Smoke Watch is an application and website based in Thailand. It started with tracking fires in Chiangrai, but now it can track fires around Thailand by using the VIIRS satellite system to track fire spots, along with a feature graph to show which area in Thailand has the most fire spots each day.

Provide communication and teaching method

2.5.1 Persuasive Speaking

Persuasive speaking is the process of convincing the audience to believe our point of view through spoken words. The speech can be everything - from a very big topic such as politics to a small topic such as where we are going. The speaker must connect with the audience well enough and engage with them. The tips that help with persuasive speaking are identifying the target audience, finding the goals of the speech, and preemptive common objections. In persuasive speaking, we want most audiences to agree with what we say. To effectively find the target audience, it is necessary to find familiar habits, likes, and dislikes. Trying to persuade the wrong audiences often produces a negative outcome. The Speaker needs to focus on the part of the issue about which the audience is still on the fence. Next, the goals of the speech need to be clear so that they can focus on the right point. The conclusion part can summarize the main points of the speech. Lastly, for objections, try to cover all the common questions before questions from the audience come up during the speech.

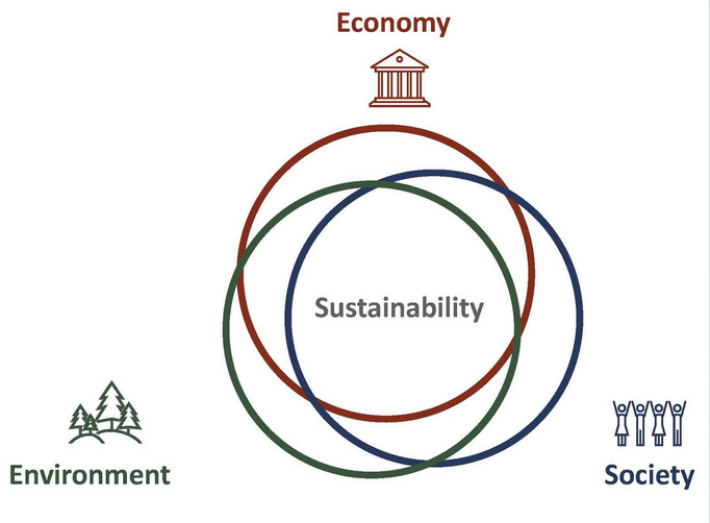
2.5.2 How to effectively teach Grade 6 students about technology

Technology has become so integrated into everyone's daily lives that there is no longer anybody who is not familiar with it, but this does not mean that everyone would be as tech-literate as others. Individuals often use the basic features in a phone, and when presented with a more "complex" machine, these individuals are often overwhelmed by the abundance of features and buttons. This is most likely caused by an uneven distribution of technology across the country, which affects the accessibility to computers. To help teach those that are not used to technology, patience is required as they may not have a frame of reference about anything they are being told, then check on them occasionally to keep track of their progress. Most importantly, it is better to let them do it themselves as that is the quickest way for them to become well-adjusted to using technology. Attempting to do it on behalf of them frequently can result in their dependency on their teacher and impede their learning. However, if there is some urgency that requires it to be done immediately, then it should be done so, and the teaching can commence when the urgency has abated.

How to complete a sustainability project and how to make it

2.6.1 Case study from sustainability in IS projects

This case study helps us understand the process of creating a sustainable project by showing us the different aspects needed in order to do so. All of these sustainability aspects would then be used so that people will be able to benefit from it in our own project. Their idea is to use the old electrical waste products to create a new byproduct and sell it in order to create another sales channel, thereby increasing the benefits of the company. The results from the article indicate that the company is designed not to change its protocols. They feel unsure about moving toward a new direction, probably because of a lack of enthusiasm and a low level of awareness. Even though the idea does have an impact on the possibility of a more thorough examination of the project's sustainability features, the company confirmed they would not change their behavior.



Method

We will make Tamfire a tool to which where it will be used to create awareness and impact on the topic of wildfire for the youth of Kor village. The creation of activity will assist in creating a sustainable community.

In order to achieve our goal, we developed 4 objectives as demonstrated:

1. Educate the students from both Ban Kor and Mae Lan schools to allow them to use the TamFire website. Their independence in using the TamFire website would then be evaluated
2. Make students understand and be able to track what direction the fire is moving and create a fire map on their own
3. Gather feedback from locals in the Ban Kor area based on their experiences with the TamFire website to make recommendations for the sponsor on how to improve the website
4. Create a situation where students would aid in the prevention of wildfire and pass on the teachings about TamFire to the next group of children.

Method

ISSP1 TamFire

GOAL

Turn the TamFire website into a tool that can be used to create awareness for wildfires by educating the students in Kor village; then to create a situation where TamFire could be taught amongst the community for the longevity of TamFire.

OBJECTIVE	Teach local students on how to use TamFire	Make students understand and predict what direction the fire can go and to create a fire map on their own.	Recommendation for the improvement of TamFire Website	Create a situation where students would aid in the prevention of wildfire and pass on the teachings about TamFire to the next group of children
TASKS	Demonstrate activities that represent each feature in TamFire website.	Research to learn how to do fire map before demonstrate to children.	Collect opinion from real user, test the website, and alternative website in order to write the recommendation to our sponsor	Meeting with park ranger on the possibility of creating the activity
	Conduct a test to check their understanding.	Teach children about fire map.	use additional information on Literature review	Planning to interpose the knowledge of wildfires and TamFire website to the "Students tourist program"
		Observe and guide children while they do fire map.	Come up with recommendation on way to enhance TamFire website.	Provide Mae Ping National Park tourist center a set of schemes and informational booklet.
		Evaluate the understanding on Fire Map.		

Objective 1: Educate the students from both Ban Kor and Mae Lan school to allow them to use the TamFire website. Their independence on using the TamFire website would then be evaluated.

3.1.1 Demonstrate 3 activities that represent each feature in the TamFire website, then conduct a test to check their understanding

This teaching method introduced TamFire to students in an exciting and entertaining atmosphere. They would learn how to use the TamFire website by getting involved in fun activities that we created for them: Each of our activities is matched with web tools which prepares their knowledge before using the website. As a result of these teachings, there is an expectation that there would be a reduction in the spread of wildfires and the response time for firefighters. The information on the activities can be seen in supplementary supply A

3.1.2 Allow the children to experiment with TamFire under our supervision.

The children were to test out the website on their own by inputting what they have learned in the previous three activities into practice. They may come to us with any queries, and we will answer them and assist them throughout the process.

3.1.3 Make a video clip introducing the website according to the basics.

The video will educate students on how to understand and use the surface, tools and menu of the TamFire web page. Using a video format, the students will be able to rewatch it to refresh their memory on how to use the website whenever they want.

3.1.4 Check student understanding

After we conducted a TamFire teaching session with the children in Ban Kor, we will assess their knowledge with our test to check their understanding. We expect that they all know every of the tools on the website and be able to use it after we have educated them. The set of question and passing criteria will be shown in supplementary supply B

Objective 2: Make students understand and be able to track what direction the fire goes and create a fire map on their own

We created an activity and a video that explains what a fire map is and how it can help them study and track the fire's origin to establish danger zones. This can assist students in understanding and controlling the area that is at risk of fire so that they can alert others about that area.

3.2.1 We must understand how to make a fire map

First, we studied how to analyze data from the TamFire and related websites to use it to make fire maps for our sponsor. There are a few steps that need to be done to combine the data and pictures from several websites. It is important for us to fully understand the process of making the maps before we start teaching others. Therefore, we plan to conduct a meeting with Dr. Jain Charnarong, the main sponsor of our project, who is also an expert on analyzing data from satellites and drawing fire maps. Our team would then use the knowledge learned from this meeting to then teach the students.

3.2.2 Teach children about fire map

After we understand what a fire map is and have learned all the information needed from our advisor, we are ready to teach the children in the schools. As stated in objective 1 that we introduced and trained students about TamFire through many fun activities. In this objective, we taught them how to track a fire to its origin and understand why the wildfire went in a certain direction instead of the other, etc., as a group teaching base.

Students learned every step of creating a fire map while we supervised them in case they had any questions. After we finished teaching them, we divided the students into 2-3 groups to participate in an activity to create the fire map by themselves.

3.2.3 Observe and guide children while they create a fire map

We checked the understanding of children by assigning them homework on creating a fire map. To explain, each child would be evaluated by making them draw their own fire map on a selected location by our member in "TamFire." Afterward, we graded the homework to see if they knew how to draw the maps properly. This would be used as an indicator to evaluate the effectiveness of our teaching.

3.2.3 Evaluate the understanding of children

Our team evaluated the understanding of children on their ability to create fire maps through an application test. This was done after teaching the children how to create fire maps, as this test would be used to determine the effectiveness of our teachings. The test would ask the students to draw firewalls and spread on fire on a map where a fire has occurred. The grading would be a pass or fail based on certain criteria we have set up.

Objective 3: Gather feedback from users in the area based on their experiences with the TamFire website in order to make recommendations on how to improve the website to sponsor

The purpose of the third objective is to receive feedback which would then be converted to reports to be sent to our sponsor for them to use to improve the website. We believe that by improving the TamFire website, it would make it easier for people in Mae Ping National Park to be aware of the dangers of forest fires, and create a safer environment for people living in fire risk areas. In this process, we conducted research on actual websites, alternative websites, and people who use them in real life.

3.3.1 Explore the TamFire website and learn how to use it.

For now, the TamFire website is the fire tracking software that was made by the sponsor with the aim to use it as one of the tools to relieve the wildfire problem in Mae Ping National Park. However, the website is only available in its beta testing form. So, trying to find features to improve the website is one of our team's main focuses which would be done by practicing and using the features of the TamFire website to gain a better understanding of the website to see whether improvements could be made. Moreover, exploring the website allows us to find any errors in the website before it reaches its final form.

3.3.2 Study alternative fire tracking software to see what can be done to improve the TamFire website.

In our study, there have already been different fire tracking websites that have real use cases such as the Idaho fire map. By looking at other preexisting websites, we could note down different features that we liked or disliked which could later be implemented into the TamFire website.

3.3.3 Survey TamFire users regarding their understanding of the website, and ask for suggestions

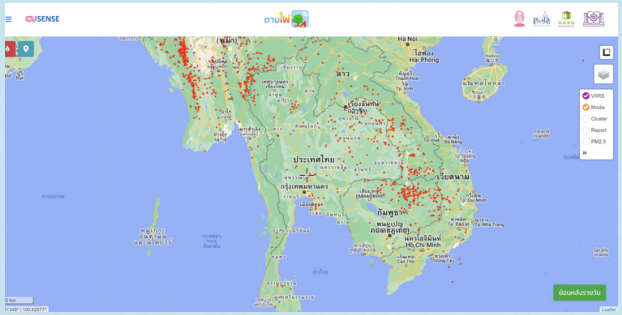
In this sub-objective, we wanted to identify the problem that the locals will face when using the website. After studying the TamFire and alternative fire tracking software, we created a survey for our study groups which were students in Ban Kor and Mae Lan schools to see if there is anything that could be changed to improve the website. Moreover, we conducted an observation to identify any problems the students had while using TamFire. The information of the observation will be collected when we teach students how to use the website (Objective 2).

3.3.4 Consult with the main sponsor about the future use cases of the TamFire website.

We want to consult with Dr. Jain and the developer of the application to gain more understanding of the real world use cases of the TamFire website. There are some features in the TamFire website about which our team does not have any idea how they would work. Hence, we conducted a discussion with our sponsor to gather more information in order to complete the report. Furthermore, we studied by analyzing the data that we received on the website such as how far the fire can go, which type of burning people make, and fire patterns. However, analyzing the data from the website requires extra research to provide a full understanding; which is why we did some literature reviews and asked different experts who are our sponsors for help.

3.3.5 Summarize all the problems and improvements about the TamFire website to sponsor

After we completed all the previous objectives, the results of this objective would be put into a report that would identify all the suggestions and problems that would be used to make the website better. Moreover, this report will also provide suggestions from TamFire users, who are students in Ban Kor and Mae Lan school, and suggestions for the improvement of the websites.



Objective 4: Create a situation where students would aid in the prevention of wildfire and also pass on the teachings for TamFire to the next class of children

3.4 Objective 4: Create a situation where students would aid in the prevention of wildfire and pass on the teachings about TamFire to the next group of children

This objective is designed as the long-term goal of educating children on wildfires. We wanted to design a program so that the community in Mae Ping National Park could operate with limited external help from agencies or volunteers. We collected information from people who have some influence in the Mae Ping National Park and came up with an activity plan to recommend to our sponsors. The reason why we decided to start with the younger generation before adults is because children have more malleable minds than adults and, therefore, it would be easier to teach and build a long-term sustainability mindset. Doing this would reduce the number of wildfires by stopping them at their roots. The result of this objective is that there would be a reduction in the number of man-made wildfires in the area within the next 3-5 years.

3.4.1 Conduct an interview with local people to plan activities

By carrying out interviews, our team found candidates who we believe to be persons who could make significant changes in the Mae Ping National Park. Our target groups are park rangers, teachers in local schools, and the elderly who are interested in our goals. To clarify, we found and contacted people who were willing to help us to lead the activities that we have provided for children so that they are able to learn and understand about wildfire and the TamFire website after we finish with the project.

3.4.2 Planning a Tour Guide program in Ban Kor

This activity is about training children in Ban Kor to be tour guides in the village. Children that participate in this activity will be recruited once every year in order to give everyone a chance. Apart from taking tourists to many attraction spots around the village and providing information, the children will also give the tourists knowledge about problems that their community faces, including wildfires. In this training, students learned how to project their thoughts and share experiences about forest fires with tourists so as to increase their awareness. We provided information about the burned area in Mae Ping National Park to teach students who participate in the program to make them ready to pass on the knowledge to tourists. Moreover, the children would gain some income from this program as an incentive to do their best.

3.4.3 Evaluate the result from these activities.

We evaluated this activity by observing the children while guiding a tour and interviewing people who were involved in this activity. Observing the children while guiding a tour allows us to see how the children work and how much they are involved with the village. Moreover, seeing them sharing their experience and thoughts with the tourists about wildfires through this activity increased their own awareness of the wildfire problems. Lastly, we learned what improvements need to be made in this activity to enhance the quality of the tour. For the interview section, we obtained feedback from people who are involved in this activity in order to gain their perception on whether it is beneficial to the children and the village and also whether it would be sustainable in the long term.

Finding and Analysis

Analyzing the efficiency of the TamFire Activities in local schools

This finding pertains to the outcome of our first objective, which was to teach local children how to use TamFire. We will conduct a test to gauge their understanding with questions that cover all features and basic understanding in the website, and the result will be used to evaluate our teaching effectiveness and provide some suggestions regarding teaching activities at the end.

Our team has designed 11 questions about the understanding of the website, and 5 questions related to practical applications of the website with a passing criteria of 75%.

The test yielded a satisfactory result for our team. The average score from 10 students in Ban Kor Judson school, and 12 students in Ban Mae Lan school are 77.5% and 82.3%, respectively, both within the passing criteria. The number of students who do not pass our criteria is students that have a score below 12 which contains only 1 student in Baan Mae LanSchool is 1 person , and 2 students from Ban Kor Judson.

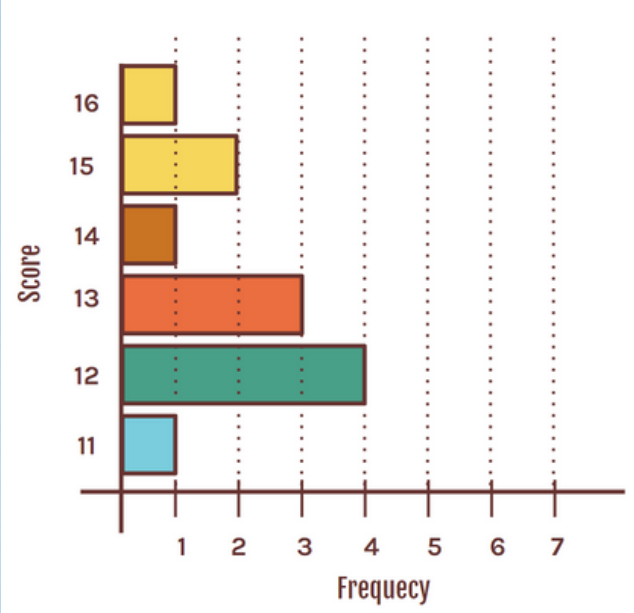


Figure 2 : Test scores of 10 students in Ban Kor Judson School.

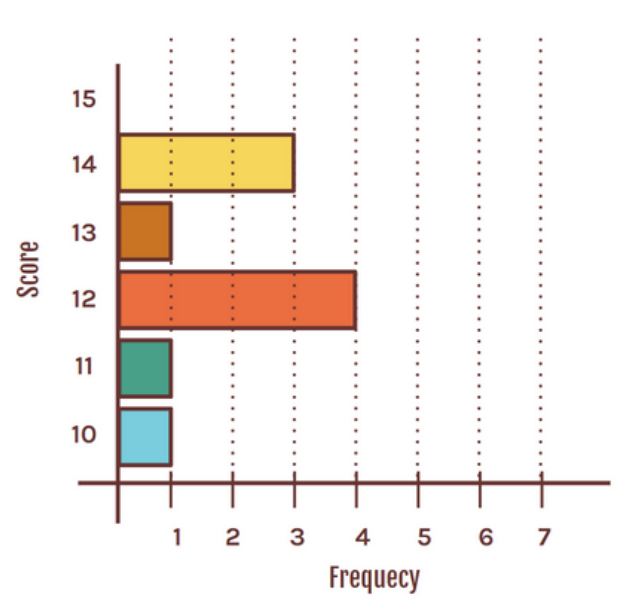


Figure 3 : Test scores of 12 students in Ban Kor Judson School.

Examine children understanding on fire map

Our second objective is teaching children about making fire maps and tracking fire from the TamFire website. Fire map is a tool used to study fire behaviors in the past, which has been proven to be effective in helping people to become more aware of wildfires. Hence why we studied from him how to construct a fire map and the concepts behind it to be introduced to other people such as the local children. Then, we observed them as they were doing the activity to check their understanding. A week later, they would be asked by us to send us another one of the fire maps to confirm that they are able to track fires by themselves. We conducted a “fire map drawing” test to check their understanding with the set of criteria found in Appendix 2. The resulting average score of the test from Mae Lan School is 83.33% with this group of students being aged around 13-14, while the average score of Ban Kor Judson School students, aged around 11-12, is 72.5%

From the result of the test on a fire map, the average score of students in Ban Mae Lan School pass the criteria on the test while the average score of students in Ban Kor Judson has not passed our criteria. However, we saw that the difference of the average score of two schools is due to the different age group in which students in Ban Mae Lan are older. Therefore, the teaching method, and pass criteria will have to be adjusted to suit students in each age group.

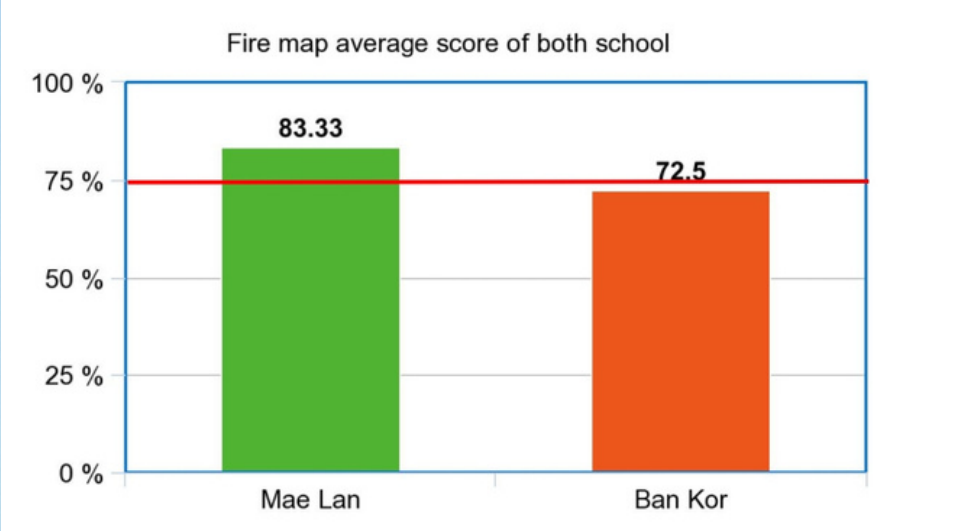


Figure 4: This diagram shows the average score of the test of fire maps of students in Ban Kor Judson and Ban Mae Lan School.

Website recommendations

As the TamFire website is not yet complete, there are many improvements and features that should be implemented into TamFire before it is ready to be fully released. This is why we made it one of our goals to make suggestions and ideas that could potentially improve the website to make it easier for people to use, especially for Ban Kor villagers who have better access to mobile phones than computers. We gathered feedback from local users about their experiences with the TamFire website so far from our team's observation during our on-site trip, survey, and meeting with other stakeholders. We have also reviewed other fire-tracking websites that are used elsewhere in the world to study and note down what features we would like to see implemented into TamFire in the future.

Problem 1: Changing the platform from website-based to application-based

Presently, TamFire is not yet an application, it is only a website that the users have to access through their device's browser engine in order to start using it. Besides, the website was designed based on the computer uses which make the layout, sizes and other functions fit for only computer usage. This is a problem as not every household has their own computer, thus people living in the village would have difficulty accessing the computer. For instance, children in Ban Kor Judsan school have to use public computers at their school for academic purposes while adults in the village do not use computers in their everyday life at all, making it problematic to incorporate TamFire into their everyday lives as the sponsor wanted.

The following bar chart shows the percentage of devices that the volunteer students used to access TamFire website. From the survey from both students on devices that they use to access the TamFire website, the percentage of volunteers at Ban Kor and Mae Lan school who use both computer and smartphone are 80, and 83 percent respectively. However, this chart only shows the percentages of the device the students use. In actuality, students access the computer only when they are at school. Therefore, students will use most of their time on TamFire with their smartphone.

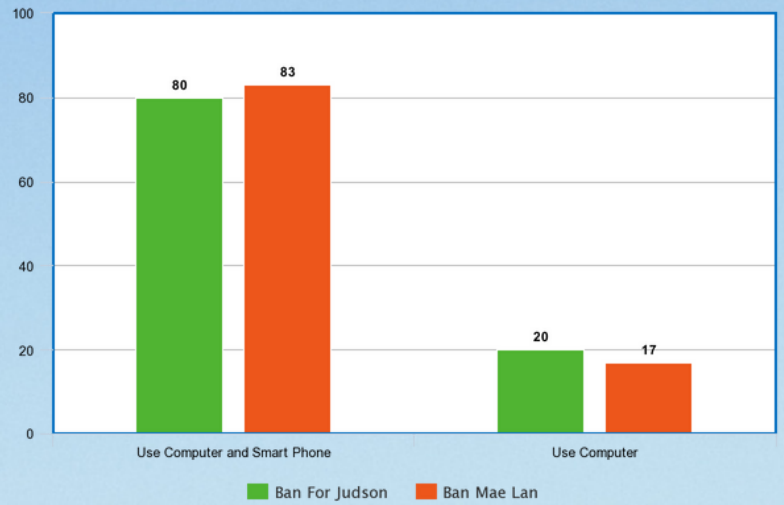


Figure 5: Chart shows the percentages of students on the devices they use to access TamFire websites.

The team has come up with the idea of changing the platform of TamFire from being a website to an application. This idea will address the mentioned drawbacks as having TamFire as an application in every smartphone will allow TamFire an easier integration into a part of the villager's daily life. People in Ban Kor will have access to TamFire anytime they want and be able to use key features such as reporting fire and checking PM2.5 levels in real time. The fire reporting feature will significantly benefit from the change of TamFire platform due to the information needed for filling in the report form containing the picture and location, which would be easier to obtain from a smartphone with camera and in-built GPS system than from computers, making TamFire as an application in the smartphone more convenient for users than as a website.

The fire tracking mobile applications that are available in the present and could potentially serve as a model for our next updated version are NAFI Fire Information App and Wildfire Tracker.

Problem 2: Make students visit TamFire website more often by adding notification and ways to deal with smoke problem feature in TamFire

From the interviews of children and volunteers in Mae Ping National Park, our team found that children barely ever use TamFire. Our interpretation of this is that the website itself does not create any interest for children to entice them to open the website often. Therefore, children might miss out on important information such as a fire taking place near their village. Moreover, our volunteers also pointed out the same point as our group had observed. They are still stumped about the best way to get the children to keep track of wildfires on their own and how we can ensure that they will keep tracking the flames once we have taught them about the website.

From the previous problem our team stated, we came up with an idea to add a new feature on TamFire with the purpose of notifying users about where fires occur in their area. This function would warn children in fire risk areas to be aware of the impending wildfire. Not only this but we can also add some suggestions about how to deal with the fire situation in the area in which the children live.

By putting this feature on the TamFire website, children would know that the fire is occurring nearby via an automated message that is linked to the information on the TamFire website. The information displayed on the TamFire website would be given to the children, saving them the time of having to check the website on a daily basis. Our team hopes that implementing this function to TamFire will help answer the volunteer's question of "how to ensure that they will keep tracking the wildfires". To illustrate, sending notifications to children will motivate them to check the websites. Also, providing a way to react to the fire situation will make the website more interesting to use and will create awareness to the children about wildfires.

From all the ideas our group has gathered, we tried to find the possible ways to make these features happen by carrying out additional research. From our research on the alternative websites, we came across useful features that are similar to the idea of NASA FIRMS and Air now website. On NASA FIRMS, there is a function called "Fire Alert". This function is used to send email alerts to people about fires in their area of interest. The alerts can be given as daily or weekly summaries in near-real-time. Users of this website can subscribe to receive the information by entering in their email address, area of interest, and fire source.

AirNow is another good example of an alternate website to which our team would like TamFire to resemble the function of AirNow that provides information on how to deal with the air quality. When you click on the circle on the map and scroll down, you can then see suggestions that would help you deal with the air quality, such as closing the windows in your home to prevent pollutants from entering. It also has information for people who are sensitive to smoke, which also gives them advice on what to do. A legend would also be a good addition to the TamFire website because it would make it much easier to comprehend what the various elements on the map imply.

Problem 3: Installation of Language choices feature

After teaching students in the Mae Ping area the use of the TamFire website, one of the main problems that we noticed is that children had difficulty in reading English, and since the website and its features are in English, they are not able to read what is shown on the website at all. It is hard for people who do not understand English to use it because they do not know where to click and how to go to the feature that they want. During the activity, we also surveyed the children so as to understand the level of their English reading skills.

The results from the survey show that students in both Ban Kor Judson and Ban Mae Lan School have a lack of understanding of English. To clarify, in figures 14 and 15, the percentage of students that can read but not understand the meaning of English in Ban Kor and Mae Lan school are 90 and 83 percent, respectively.

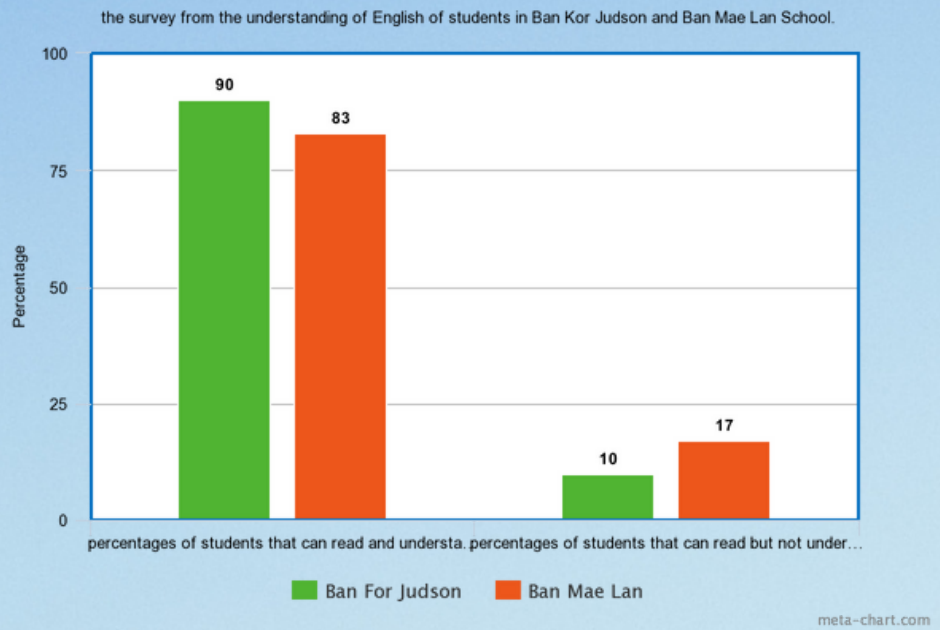


Figure 6: The survey on the understanding of English of students in Ban Kor Judson and Ban Mae Lan

To improve the website to make it more user-friendly so that people who can and cannot understand English can use it, we suggested a feature that allows users to change the language between Thai and English. It could be a button that switches languages between Thai and English or could be a list for the user to choose from if more than 2 languages are required. The results of this suggestion would be that more people can assess the TamFire website and would be willing to use it since they can understand all the features.

Problem 4: Add location bookmark and search feature for easier finding of spots on the map

Finding locations on a map can be challenging due to the geographical placement of some sites, which makes it difficult to identify them even when zoomed in. While TamFire, like many other websites that use the map, has a "current location" button, it lacks the bookmark and search options that are seen on most other fire tracking websites. The absence of this feature makes it inconvenient for users to keep track of long-term fire situations in the same area as they will have to find it on their own, again, after logging out of the website.

While this does not stop TamFire from functioning properly, it does make it a little more difficult for some users who are not as patient as others to zoom in and out of the map to discover spots. Because of this, the developers of TamFire should implement the bookmark and search features into their website in order to make it easier to use by simply typing in the name of locations to find them and bookmark their coordinates permanently. With these features, the users will be able to search for any place on the map they want to see and bookmark its coordinates so that the next time they use TamFire, they will be able to immediately go to the place they visited on the map the previous time with the references from the bookmarks.

Problem 5: Identify symbol, some words, how to use backtrack feature

Following our observations of students using the application and after having interviews with TamFire activity volunteers, we received feedback on a variety of topics. The most prevalent issue we have seen is that many individuals are confused about how to utilize the traceback system to understand the sign on the map. The symbol's biggest flaw is that there are no instructions or manuals to assist users in comprehending what the red, yellow, and gray color dots on the map mean. The satellite choice is also confusing since people who are unfamiliar with satellites are unsure which one is best for them.

From our observations of students in Ban Kor and Mae Lan school, 34 percent of Mae Lan students and 30 percent of Ban Kor students are confused and unable to utilize the backtrack system to understand the sign on the map. The main factor behind these statistics is that there are no instructions or manuals to assist users to comprehend what the red, yellow, gray dots in the TamFire website.

From our observations of students in Ban Kor and Mae Lan school, 34 percent of Mae Lan students and 30 percent of Ban Kor students are confused and unable to utilize the backtrack system to understand the sign on the map. The main factor behind this statistics is that there are no instructions or manuals to assist users comprehend what the red, yellow,

The suggestion we came up with is to create a manual or website interface that will teach every user how to use the website before they use it, as well as a feature in the menu to access the instruction at any time so the user can more easily explore the TamFire website. Because the goal of the TamFire website is to make it as user-friendly as possible, a video explaining how each system works will also be included.

Based on what we have seen, many other fire report websites have the same idea to help users understand how to use them. The Idaho fire map has detailed information on the symbols of the map labeled in the label tab for users to understand.

The suggestions for improvement have not yet been submitted to our sponsor as our team does not have the ability to develop or change the TamFire website in any way. As a result, we still have yet to receive precise data on the website's improvement, but the goal to make TamFire as user-friendly as possible and widely available to all Thai users remains the same regardless.

NASA FIRMS is another website that can be used to demonstrate how the fire tracking system can be used. NASA FIRMS has a help section where users can learn about every part of the website and how to utilize it. This help section can explain the differences between settings so that users can learn more about how the satellite works and how they can utilize it in different situations.

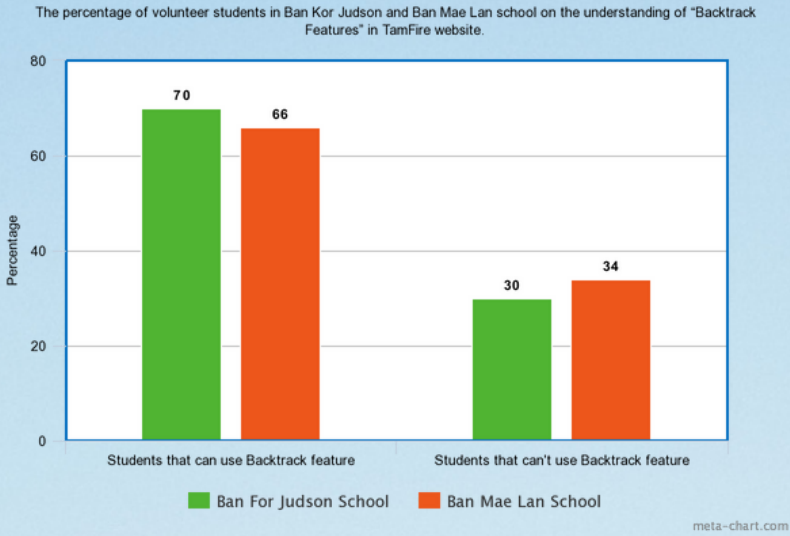


Figure 7: The percentage of volunteer students in Ban Kor and Ban Mae Lan school on their understanding of “Backtrack Features” in TamFire website.

Information about tour guide program

From our research, we can conclude that the tour guide program can help the children pass down their knowledge about fire prevention through storytelling about the background of attractions around the Mae Ping National Park. From our interview and meeting with park rangers, we concluded that this program is very interesting, and park rangers would like this activity to happen in the near future as they have planned to do this before, but no one has come forward to take on the burden. Since the children in the Mae Ping area are expected to become leaders of the villages, we wanted to start with children and make it long-lasting.

After we had a meeting with the park ranger on the topic of setting up an activity, we decided to prepare a set of schemes and gave it to the Mae Ping National Park tourist center, which included an itinerary and an information booklet. These two tools will be great in helping locals develop and rectify their understanding which the Mae Ping National Park tourist center would be in charge of after we have completed the project. Involvement in this outside school activity can give them leadership skills and higher responsibilities. If older children participate in the activity, they can pass on the knowledge and necessary skills to the younger ones to establish a standard for the activity.

This program is composed of three roles: park rangers, children, and tourists. This activity not only helps them to gain more income but the hidden motive behind this activity is to connect the students with nature so that the children would feel they have an obligation in preserving the forest.

An Interactive Social Science Project submitted to the Faculty of science chula university in partial fulfillment of the requirements for the Degree of Bachelor of Science

Conclusion and Recommendation

Project Conslusion

This Interactive and Science Social project, with the usage of the TamFire website, made by the sponsor, takes advantage of satellite imaging to allow locals in the Ban Kor area to track and locate wildfires. The website would then send notifications to warn against fire risk areas and for the reporting of sightings of wildfires. The reports would then be used by the first respondents to control the fire. This project aims to use technology in a way that would reduce the amount of forest lands lost and dangers that are the results of wildfires.

As said in the methodology, to ensure that the locals gain the best experience from the app, they would be taught how to use the website to properly identify danger areas and to report information on existing wildfires. This would be done through classes that would teach the adults and children of the village the different features of the TamFire website. Not only are the locals going to be taught how to use the website, but feedback would also be gathered from the locals to improve the viewing experience and ease the use of the website for the locals. The process of acquiring feedback would be carried out through surveys and through tests that would assess the locals' ability to use the website properly.

Overall, this project is expected to not only be successful in educating the locals on the hazards that come from wildfires and how to deal with them but also increase their quality of life in fire risk areas. There would be an overall positive outcome as a result of this project, which has the potential to save and improve many lives.

With the issues and findings presented above, we have come up with the following recommendations and suggestions to the stakeholders within Mae Ping National Park and sponsors in order to help reduce wildfires by using TamFire as a tool in the future. We think these small steps could help the locals improve their situation in a short-term period of time.

Recommendations

1.) *We recommend students should use the TamFire website for the benefit of their lives.*

From the result of the test, most children know how to use the websites. However, just knowing how to use the website and passing the test are not the final results we are aiming for. Our team wants children to apply the lessons they have learned to benefit their lives. The expected result in the future on this objective is that children will continue to use the TamFire website in their daily lives to gain knowledge on wildfire, pass on the knowledge to new volunteer students, and raise the awareness with other people about wildfires with the supported data obtained.

From the observation on the teaching of Fire maps in both Ban Kor and Mae Lan schools, it is evident that most children can create their own fire maps. However, there are some points that can be improved. Starting with, we recommend that adjusting the teaching style to suit the different ages of students is necessary for the understanding of children about fire maps. Moreover, an understanding of geography should be instilled before teaching fire maps. From our observation, children have a misunderstanding about the direction of the fire. To explain, the questions that most students got wrong are due to their lack of understanding of geography.

3.) We recommend that the development of TamFire website will implement the feature that our team suggested in objective 3 to be added in the website.

We expect the developer to take our suggestions into consideration and use them to improve the TamFire website. Our team wants the TamFire website to become user-friendly,
accessible, and widely used for the improvement of the community.

4.) *We suggest to the Park Rangers to conduct the activities that motivate children on wildfire prevention, and knowledge of wildfire.*

One of the programs we created to incorporate wildfire information into the activities in which youngsters can participate is the tour guide program. Our team believes that children's minds are more pliable than adults, which is why we want them to participate in the tour guide program. Children will be motivated to safeguard nature if tour guide activities are held or if new activities are implemented. The long-term goal of this objective is to limit the number of wildfires by putting out the fires at their source. The youngsters will grow up with the mindset of wanting to view a beautiful environment and live a healthy lifestyle.

5.) We recommend that local schools take action on wildfire education.

School is crucial to children because it is the first place where they learn the fundamentals of information that will allow them to progress to more advanced topics as they grow older. For this reason, it is important that the children learn about the dangers of wildfire as well as how to prevent them by using TamFire while they are still young and open-minded. School is also where the children gather to learn and socialize together, making it an ideal location to establish instructional activities for them to partake in and learn for their own benefit in the future. Given these reasons, combined with the success of our recent activities, there should be no reason why similar programs to raise wildfire awareness among young children cannot or should not be developed by the school on its own.

Suggestions for Future Researchers

In order to help future researchers continue with the work that we have done, we came up with a few suggestions for project ideas. This was done to not only continue progress into the future but to continue it in the most effective way possible. All of these suggestions would be a continuation of all 4 objectives.

Suggestion 1

This would be a continuation of objectives 1 and 2, where we educated and tested the knowledge that we passed on to the children in the two schools. The reason for the sponsor asking us to teach the children living in these areas about the effects of forest fires was to reduce the number of man-made forest fires. Future projects could determine the effectiveness of our teachings on reducing the number of man-made forest fires by monitoring the amount of man-made forest fires for a certain period of time. Ideally, the range of time for monitoring should be in years. Doing so would determine whether teaching the students to reduce the amount of man-made forest fire is a worthwhile pursuit and allocation of time.

Suggestion 2

For suggestion 2, we would recommend tracking the respiratory health of villagers in the area. We believe that this is one of the most crucial project ideas as reducing the number of particulates in the atmosphere was the main goal of the sponsor from the very start. This suggestion would be a continuation of objective 3 where features such as fire notifications and safety procedures would be implemented into TamFire. Monitoring the respiratory health of the villagers would tell whether these new features implemented into TamFire helped in reducing the exposure of the villagers to air particulates that would be dangerous to their health.

Suggestion 3

Lastly, this suggestion would be a continuation of objective 4 where we partnered with the park rangers to set up a tour program to spread awareness of the dangers of forest fires. We suggest future projects to continue collaboration with the park rangers in order to expand the tour. Expansion of the tours would mean that more tourists would come to the park, which would then mean more people would be educated on the dangers of forest fires. Additionally, a survey could be conducted to determine the effectiveness of the tour in spreading information about TamFire to the tourists. The survey would interview the tourists to get an understanding of the lessons they received from their experience with the tour. Furthermore, as the goal of objective 4 was to pass on the knowledge about TamFire to future students, the students could also be interviewed as well.

To take further steps from our objectives, our team devised a strategy that involved merging four objectives to accomplish the ultimate goal. First and foremost, the TamFire website should be improved to attract new users and retain existing ones. The next stage in developing the websites is to educate people about the Tamfire website and to put the website to practical use. We will provide an excellent teaching strategy that has received positive feedback from students and schoolteachers to serve as an idea to teach the next batch of volunteer students. The final stage is to ensure that TamFire and wildfire knowledge are maintained in the community. We advocated for the formation of a wildfire club or activity in order to educate children, who are the future leaders of the community.

We recommend sponsors to start by first focusing on 3 key findings because the website is the first step toward the usage of users. If users do not have a good website, other findings won't be as effective on teaching and expanding beyond the scope.

Supplementary supply

Supplementary supply A

3.1.1 Demonstrate 3 activities that represent each feature in the TamFire website, then conduct a test to check their understanding

This teaching method introduces TamFire to students in an exciting and entertaining atmosphere. They would learn how to use the TamFire website by getting involved in fun activities that we created for them: Each of our activities is matched with web tools which prepares their knowledge before using the website. As a result of these teachings, there is an expectation that there would be a reduction in the spread of wildfires and the response time for firefighters.

3.1.1.1 Activity 1: Map matching

This activity teaches students to understand the types of the maps that appear on the website menu. We taught them to understand different map types and when to use them to allow them to have a better understanding of their village. In this activity, students would play a matching game between the type of map and its name. We created 5 pairs of maps and names in a medium size PP flute board to make it clearer to explain. We explained the differences and the use cases of each map and later let the students explain it back to us and try the matching game. This kind of activity is designed to create a fun interactive style of activity.

3.1.1.2 Activity 2: Area measuring

This activity taught children how to measure the area and determine the scales on the map to study if a fire is occurring in a large area and to find the area by using one of the website tools. This helps the student understand the idea of how to measure the area on the TamFire website.

The students were divided into 3 groups and measured the perimeter of the given area by using a measuring tape. 3-4 people from our team would supervise the students and let them measure how far apart we stand and convert it to a perimeter. The group that can quantify the nearest answer wins a snack.

Figure 3: Measure the perimeter of the area activity

3.1.1.3 Activity 3: Report trail

In this last activity, we taught students the most important feature in the TamFire website, the reporting of fire sightings. This feature of TamFire allows users in the area to report fire sightings in real time. This allows the user to describe the details of the fires and also upload a picture (see in Figure 3). We taught students how to write down the information about the wildfire in the most informative way possible to be useful and easier for the staff and firefighters to benefit from it. Moreover, we enhanced their enthusiasm by using Ban Kor as a simulator world and we simulated fire events around the school to teach students how to report the data. We believed that students would easily understand the activity as it would be a fun break from their classes.

To begin this activity, 3 people from our team represented 3 fire spots where students would need to record the information on the paper provided to them. We wore the fire-headband that we created ourselves and then located ourselves in 3 different places around the school for the children to find us. The information that students must fill in the form consists of 6 pieces of information which are the name of the fire event, the description of the fire event, date, time, latitude, and longitude of the location.

3.1.2 Allow the children to experiment with TamFire under our supervision.

The children were to test out the website on their own by inputting what they have learned in the previous three activities into practice. They may come to us with any queries, and we will answer them and assist them throughout the process.

3.1.3 Make a video clip introducing the website according to the basics.

The video educates students to understand and use the surface, tools and menu of the TamFire web page. Using a video format allows the students to be able to rewatch it to refresh their memory on how to use the website whenever they want.

Supplementary supply B

ASet of questions on the understanding of the website

1. State the use of the following maps on the TamFire website.

1.1 Google Streets

Ans...A regular map that shows routes and roads.

1.2 OpenStreetMap

Ans...An editable map under The Free Wiki World Map with more detailed map information with localization of districts and sub-districts.

1.3 Google Satellite

Ans...Shows a map photo taken by a satellite.

1.4 Google Terrain

Ans...Shows a topographic elevation data of each area/location.

1.5 Google Hybrid

Ans...Displays both a regular map that shows routes and roads and a satellite-based map together.

1. Explain the use of the following detection tools in TamFire website

2.1 MODIS

Ans... A satellite-based sensor that scans Earth's surfaces for hot spots four times each day with a resolution of 1,000 meters per pixel.

2.2 VIIRS

Ans... A satellite-based sensor that scans Earth's surfaces for hot spots two times each day with a resolution of 375 meters per pixel. (More detailed than MODIS)

2.3 Cluster

Ans... Detects continuously burning forest fires.

2.4 Report

Ans... Shows the location where fire reports are made by TamFire users.

2.5 PM2.5

Ans... Indicate the PM2.5 level in each area.

1. What button should a user use when seeing a fire that has taken place?

Ans... "Fire report in an area"

Set of TamFire applied questions for real-life usage

1. Measure the PM2.5 level in the Kor Sub-District Administrative Organization area on December 19, 2018.

Ans... 36

1. Measure the distance between the sunrise viewing point, Pha Daeng Luang, to Kor Noi Waterfall.

Ans... 6.5 kilometers (Answer within the range 6 km - 7 km = Correct)

1. There were wildfires in the Kang Kor area last December, on what day did it first start and when was it put out?

Ans... Around December 20th-25th

(This question tests an ability to make use of dates and an understanding of the meaning of colored dots – grey, yellow, and red.)

1. On 01/02/2022, an area at the bottom of Mae Ping National Park (surrounded by Ping River) caught fire. Describe the terrain where the fire started and the direction of the fire on the next day (02/02/2022).

Ans... Ridge/mountain terrain, uphill direction

(This question requires users to be able to change the map and explain the fire direction)

1. Find the location of the fire in Om Koi Wildlife Sanctuary on 23/01/2022 to 26/01/2022

Ans... lat 17.7325 lon 98.6121