Location-Based Safety Alert System Using Android Phone

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***Abstract*—There is restriction on the usage of mobile phone in certain potentially dangerous premises such as petrol station and hospital. The usage of mobile phones at those premises might cause some disturbances and hazards. Therefore, safety precautions need to be taken into consideration when we are within the premises. Unfortunately, there are still many users who disobey the rules and use their mobile phone in those areas. Therefore, mobile phone detector is used to monitor the usage in the premises. Thus, software approach is implemented. The design of this location-based safety alert system will make the smartphone to intelligently detect the user's location all the time after it is activated. It will alert and ask the user to switch to airplane mode once the system detects the user is in those premises. Thus, the safety alert system not only acts as a reminder to reduce the chance of the accidents occurring to the user itself, but also allocate a safer surrounding to the public.**

Keywords—location based; alert system; android phone

I. INTRODUCTION

Apparently, there is restriction on the usage of mobile phone in certain potentially dangerous premises such as petrol station and hospital, therefore mobile phone detector is needed to monitor the usage in the premises. The usage of mobile phones at those premises might cause some disturbances and hazards. Therefore, safety precautions need to be taken into consideration when we are within the premises.

A. Hospital

The hospital will define and control their own wireless network equipment and the working frequencies. The wireless network will use with enough certainty to ensure that there will not be interference with the patient monitoring equipment. However, the wide variety of handsets and the multiple operating cellular telephone services nowadays make it harder to ensure that there won't be any interference.

Mobile phones can interfere with pacemakers and other sensitive electronic monitoring devices in hospital. It is a sensible safety precaution, but it is quite conservative since cell phones will disturb less than 4% of devices at distances of less than 40 inches. Still, there are other good reasons to restrict mobile phone usage in hospital. Ringing phones and the conversations can be noisy and disruptive to patients [1].

B. Aircraft

Passengers are reminded to switch off their electronic devices during the flight. The ban is needed because the radio frequency emitted by cell phones is suspected to malfunction a plane's electronic systems [2].

Radio-frequency (RF) emissions from mobile phones, laptops, tablets and other electronic devices might occur at the same frequencies used by aircraft communication, navigation and surveillance radio receivers. The RF emissions could cause fluctuations in navigation readouts, disturbance in other flight displays, and interference with air traffic communications [3].

Mobile phone manufacturers have placed the warnings in their user manuals. For instance, Nokia warns its users that not to use phones on airplanes as this can cause interference with the navigational equipment [4].

C. Petrol Station

The mobile phones can ignite sparks generated by the phone battery and produce static charge during the transmission. Petrol fuel has low electrical conductivity and does not conduct electricity under normal condition. However, static electricity charge will be produced as the fuel flows through the nozzle. In general, the static charge will dissipate in the range of few seconds to few minutes after reaching the maximum level of the tank. The spark produced needs to be discharged near the tank opening. It is also possible for a spark to discharge directly from the gasoline surface to the grounded nozzle [5].

Studies had been conducted and no concrete proof was found on the safety issue regarding the usage of mobile phones in potentially explosive environments. Even though there is no solid evidence on the ignition source, the usage of the mobile phones while refueling vehicles is strongly prohibited by the authorities because it may divert concentration and lead to spills out and possible accidents [6]. Mobile phone manufacturers also strongly emphasize on not using their phones in areas with potential explosive atmospheres, as there are issues regarding to static electricity not associated with mobile phones [7].

A mobile phone detector called "Mobile Phone Usage Alert System for Petrol Station", also known as "Call Buster", had been developed by a previous batch student. The mobile phone

detector can sense the presence of an activated mobile phone from a distance of 1.5 meters. The detector operates by detecting the incoming and outgoing calls, text messages and video calls. Once the RF transmission signal is detected, the alert system will be triggered immediately [8].

However, not all phone signal can be detected by the mobile phone detector. It had been tested for several times and it was working fine with most of the phones except iPhone and some Samsung Android-based phone models. The circuit of the detector was then modified to fix the problem but it still failed at last.

D. Scope of Project

Nowadays, the most common problem in this world is the unauthorized usage of mobile phones in prohibited areas such as examination halls, confidential rooms, prisons, colleges, hospitals, airport, court, and petrol station. This best way to prohibit the unauthorized usage of the mobile phones is to disable the communication feature of the mobile phone temporarily. Hence, a software-based location-based safety alert system is designed to detect the user's current location. If the user is near or inside the potentially danger area, the safety alert system shall alert the users by buzzing an alarm sound. Therefore, the user will be informed that they are in those restricted area. They are reminded to activate airplane mode which disable the communication feature of the mobile phone temporarily. Hence, the safety alert system may reduce and minimize accidents in the restricted areas by notifying the user to not use their mobile phone.

II. PROBLEM STATEMENT

A. Aircraf

Using mobile phone aboard planes (refer Fig.1) is banned by almost all airlines and by the air traffic regulations of most countries. However, problems can still arise when passengers forget to switch off mobiles.

Mobile phone and other electronic devices can cause the auto pilot to disengage. The instruments which guide pilots in bad weather can also be affected by the electrical signals from such devices. This may bring potentially catastrophic consequences [2].

An inquiry into the crash of Crossair flight LX 498 (refer Fig. 2) which crashed just after take-off, is focusing on a link with mobile phones after testing with the Saab 340, a same model of Crossair flight LX 498 airplane. The tests showed that navigation system of Saab 340 could be disrupted by a mobile phone [9].

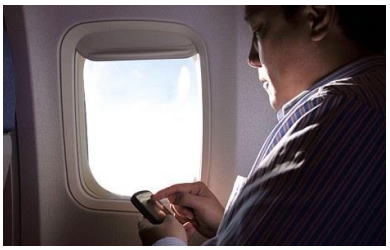

***Fig. 1* Passenger using mobile phone on the plane.**

***Fig 2.* Crossair Flight LX 498 crashed site.**

B. Petrol Station

Signboards can be found in petrol station to remind users not to use their mobile phones as shown in Figure 3. However, not much people follows the rules. Some users still make phone call when they are refueling. The carelessness of users could bring serious consequences to the other users in the petrol station. The highly flammable petrol can cause the tragedy such as fire or explosion [10].

Figure 4 shows the accident site at Petronas petrol station. The accident was caused by the usage of mobile phone when a user was pumping gas into the cylinder.

Fig. 3 Mobile phone is prohibited in petrol station

Fig. 4. **Accident site where explosion of gas occurred when people using their phone.**

III. PROJECT PREPARATION

In this project, the focus is on the mobile application development. The mobile application utilizes the built-in GPS in Android smartphone to detect the user's location. It will then trigger an alert if the user is at the potentially-hazardous place. A solar charger will be designed too for the phone attached in this alert system. Figure 5 and Figure 6 show the basic idea or concept on the software and hardware respectively.

Fig. 5. **Basic idea on the software Graphical User Interface (GUI)**

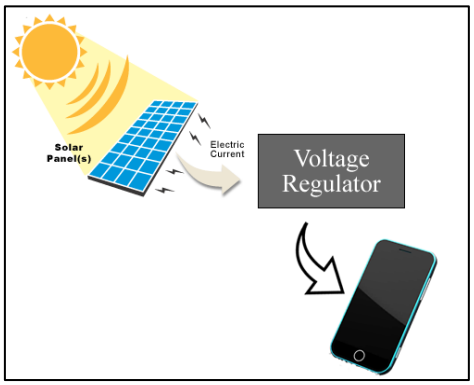

Fig. 6. **Basic idea on the hardware – solar charger**

Location-based Safety Alert System acts as a reminder to users that they are not allowed to use their mobile phones in certain areas. It is very applicable and useful to the places where usage of mobile phone is strictly prohibited. For example, usage in petrol station and gas industry, airport and aviation industry, confidential rooms, hospital, prisons, government office, courts and commercial buildings. This project is suitable in all the places mentioned earlier because the safety alert system is aimed and depended on the users. The users will be alerted and reminded to disable the communication feature of their phones if necessary. Hence, the safety alert system will minimize the risk and accident, especially on the petrol station and promotes safety to people and also the surrounding buildings.

The software part will be utilising any smartphone with GPS chip to detect the places at which the usage of handphone is prohibited.

Eclipse is a Java-based open source platform that allows a software developer to create a customized integrated development environment (IDE) from plug-in components built by Eclipse members. It contains a base workspace and an extensible plug-in system for customizing the environment.

Eclipse is very different from traditional IDEs in a number of fundamental ways. The Eclipse platform, when combined with the Java Development Tools (JDT), offers many of the features you'd expect from a commercial-quality IDE: a syntax-highlighting editor, incremental code compilation, a thread-aware source-level debugger, a class navigator, a file/project manager, and interfaces to standard source control systems, such as CVS and ClearCase.

Eclipse is easy to use, it does not only allows the programmers to create simple GUI application, but also can develop complex application as well. Eclipse has more functionality which includes the combination of control on a form by visually arranging the components, specify attributes for the actions of those components, and writing additional lines of code for more functionality. A simple GUI can be created by dragging and dropping the components needed, functions can be added by multiple lines of code. Figure 7 and Figure 8 show some drafts of the user interface layout of the application.

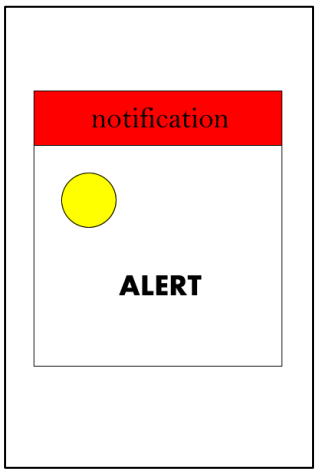

Fig. 7. **Notification GUI**

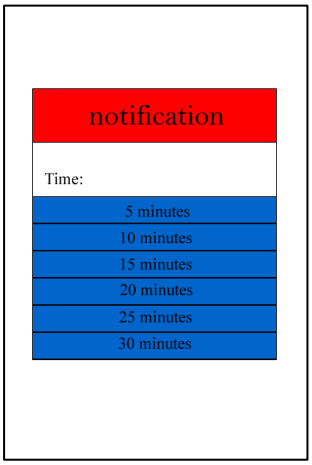

Fig. 8. **Time Chooser GUI**

IV. PROJECT FLOWS

According to Figure 9, the system will show the Google Map to show the user's current location and the current latitude and longitude. The system will keep on updating the location of the user. Even the system is paused and back to the phone main menu, the system will be turned on again and work in background every 10 seconds.

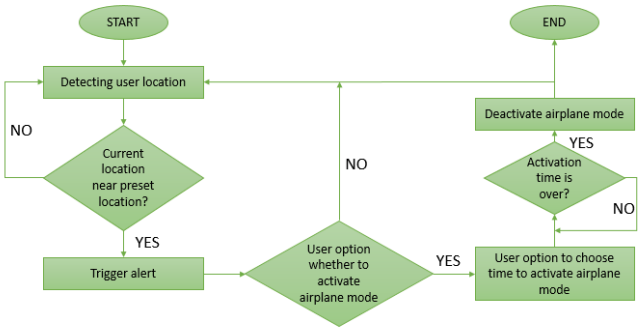

Fig 9. **The process flow of the software**

When the user is near the preset location (danger area), the system will trigger an alert notification with a buzzing alarm to tell user that he or she is in the danger area that usage of phone is prohibited. The alert notification is all about a pop-up menu asking users to choose whether to activate airplane mode or not. This is a counter-measure to overcome if misalarm happens since the accuracy of GPS is varied from every phone. If the user chooses to activate airplane mode, another pop-up menu will appear and ask for the time to activate airplane mode. The options are 5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes, and 30 minutes. Said if the user chooses for 5 minutes, the phone will automatically change back to normal phone mode. This helps the phone to gain back the communication function in case the user forgets to turn it back on. If the user is still in that area after 5 minutes, the airplane mode is deactivated and the system will be continuing to detect the current location of user. The system will immediately know the user is in the danger area again, alert notification will be fired up and the buzzing alarm will alert the user.

A. Hardware Development

The hardware part will be the solar charger for the alert system. It supplies the electricity to the alert system continuously to sustain the power-consuming GPS alert system. Therefore it is best used in the car when driving. The alert system will be supplied with electrical energy generated from the solar panel directly after regulating the voltage by the voltage regulator LM317. The overall circuit will be designed by using Proteus 7.7 SP2 and fabricated upon success. Then, the hardware will be tested to ensure that it is functioning as desired. This Proteus software has features like professional schematic capture and Printed Circuit Board (PCB) design providing automated component placement, track routing, design validation and other functions. It makes the users to convert the circuit designed easily into a PCB layout so that etching can be done to produce the PCB.

B. Designing the Solar Charger Circuit

The solar charger circuit shown in Figure 11 produces a stable voltage of 5V to charge up the phone attached in the safety alert system via USB. The solar panel will give an output voltage of 6V to the circuit. The output voltage will be connected to the input of the voltage regulator. The voltage regulator LM317T will convert it into 5V by controlling the 2KΩ potentiometer. Next, the output of the voltage regulator will be connected to the USB female connector pinout.

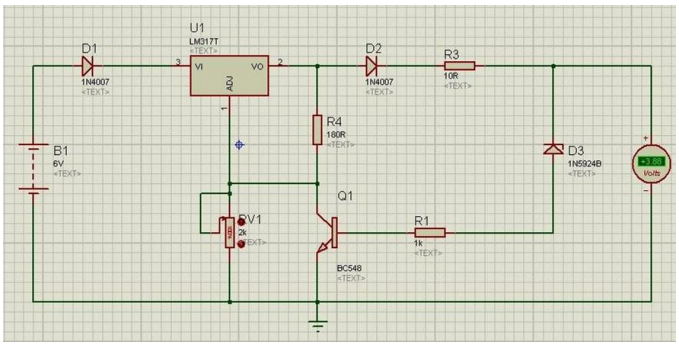

Fig. 10. **The schematic diagram for solar charger**

Figure 11 and Figure 12 shows the complete circuit for the solar charger circuit. The size of the circuit is measured to be of 6.5cm height and 5cm width. With such a small size, the circuit is portable to place at any places.

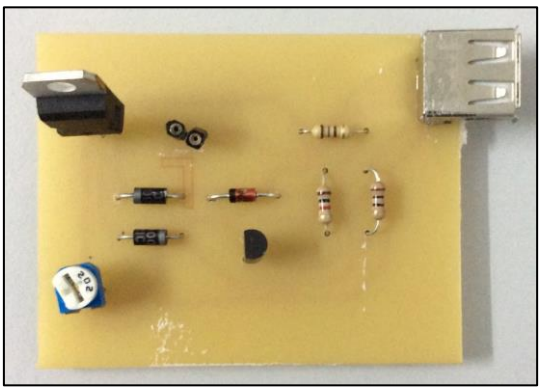

Fig. 11. **The PCB front view for solar charger circuit**

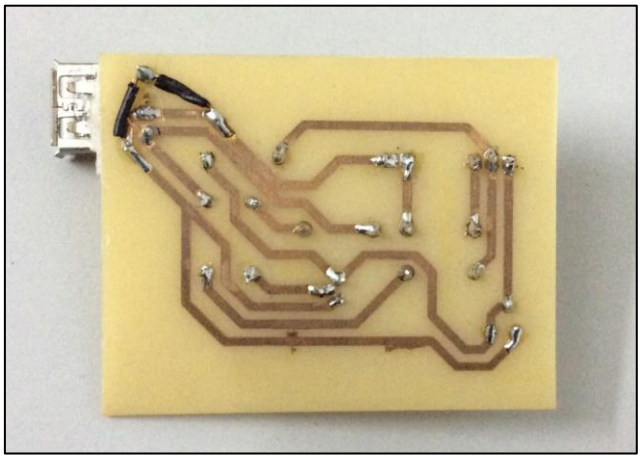

Fig. 12. **The PCB back view for solar charger circuit**

V. THE APPS

This safety alert system is utilizing the GPS and internet data. The internet data is needed to show the Google Map to show the user's current location whereas the GPS is used to detect the current latitude and longitude of the user. The system will keep on updating the location of the user. Even the system is paused and back to the phone main menu, the system will be turned on again and work in background every 10 seconds. Figure 13 shows the mobile application main GUI. It can show the current location of the user and its latitude and longitude.

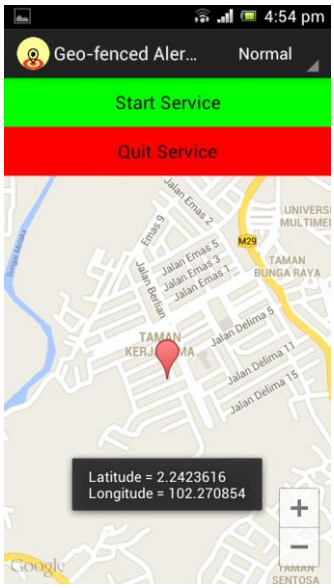

Fig. 13. **Main GUI of the Location-based Safety Alert System**

Figure 14 shows that when the user is near the preset location (danger area), the system will trigger an alert notification with a buzzing alarm to tell user that he or she is in the danger area that usage of phone is prohibited. The alert notification is all about a pop-up menu asking users to choose whether to activate airplane mode or not. This is a counter-measure to overcome if misalarm happens since the accuracy of GPS is varied from every phone. If the user chooses to activate airplane mode, another pop-up menu will appear and ask for the time to activate airplane mode. The options are 5 minutes, 10 minutes, 15 minutes, 20 minutes, 25 minutes, and 30 minutes. Said if the user chooses for 10 minutes, the phone will automatically change back to normal phone mode. This helps the phone to gain back the communication function in case the user forgets to turn it back on. Figure 15 shows the time chooser option menu for the safety alert system. Figure 16 shows the phone is in airplane mode by seeing at the aeroplane icon on the status bar.

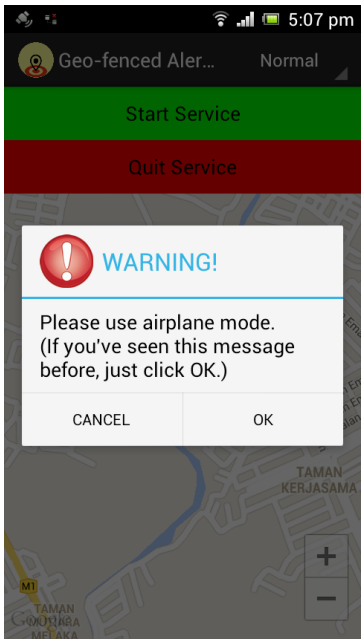

Fig. 14. **Notification is being triggered upon entering the petrol station.**

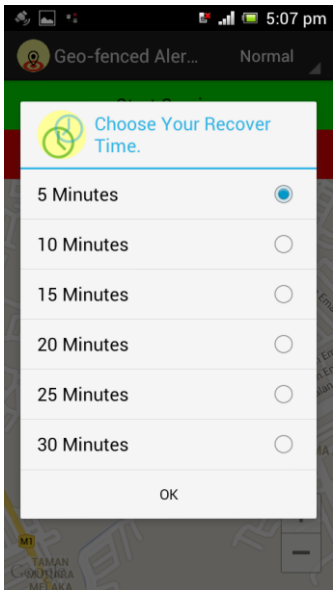

Fig. 15. **Time chooser option**

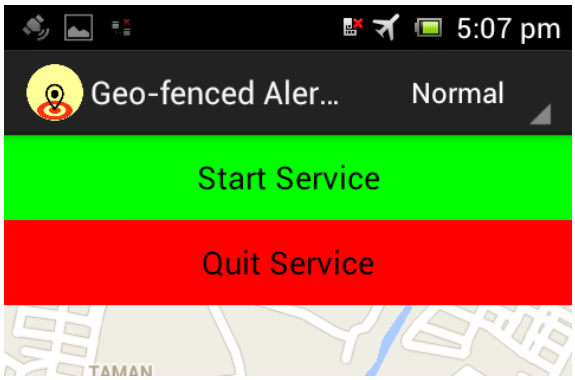

Fig. 16. **The airplane mode is activated**

Another case, if the user is still in that area after 10 minutes, the airplane mode is deactivated and the system will be continuing to detect the current location of user. The system will immediately know the user is in the danger area again, alert notification will be fired up and the buzzing alarm will alert the user.

Table 1 shows the comparison between the mobile phone detectors (hardware) and the location-based safety alert system (software). The hardware-based system is more towards active mode, as they are continuously searching for phone signal. However, the software-based system is more passive, as it depends on the user decision whether to follow the notification or not. The users must have a proper attitude and awareness on the safety issues.

Table 4.1: Comparison between the systems

	HARDWARE (ACTIVE)		**SOFTWARE (PASSIVE)**
Features	Wolfhound Cell Phone Detector	Mobile Phone Detector By Tan Chen Wei	LOCATION-BASED SAFETY ALERT SYSTEM USING ANDROID PHONE
Ability to Detect / Transmit Signal	Both	Both	N/A
Range of signal detection / location	Up to 5 meter	Up to 3 meter	Radius of ≈ 50 meter to 100 meter

Time needed for signal/ location Detection	30 minutes (signal)	Immediately (signal)	Immediately (location)
Sensitivity of Signal Detection	Randomly (Standby & Switch off mode)	Randomly (Standby mode)	Detects location
Is all phone signal can be detected?	Yes	Except iPhone, some models from Samsung	As long as it can be installed, it can tell the restricted location

A. Prototype of the Project

Figure 17 shows the prototype of this project is built by using a plastic box. The size of the prototype is measured to be 16.5cm x 12cm (height x width) which fits the typical size of the car dashboard. The solar panel is placed on top of the plastic box. The solar charger circuit is placed inside the plastic box with the USB output pin exposed at a small opening of the box.

Fig. 17. **The prototype for the location-based safety alert system**

VI. CONCLUSION AND FUTURE WORK

The location-based safety alert system using Android phone is software-based to cover the flaws found on the mobile phone detector hardware. After the mobile application is activated, it will continuously track the user's location in Google Map using the GPS embedded inside the smartphone. It will trigger an alert to the user upon entering the potentially-dangerous premises. The alert notification will then remind the user not to use handphone in the specific areas. The system will turn into airplane mode after the user chooses the activation time for airplane mode. After the activation time, the phone will be turned back automatically to normal mode to gain back communication feature. The alert system utilizes the potential of GPS chip (where communication between the satellite and GPS chip is engaged) embedded in the smartphone throughout the application. Internet data is needed to show the Google Map. A solar charger is built to compensate the great power consumed by GPS chip.

At this moment, the safety alert system can only detect one particular location. In near future, multiple locations can be detected to make it become more practical. Any new targeted locations, for instance newly-built petrol station or hospital, their GPS location can be added by updating the database of the application. The users can just update the minor part of the extension instead of updating the whole application.

Internet data is still needed to show the Google Map, so that the user can know where he or she actually is. However, this is inconvenient to those users who are not the data plan subscriber. Thus, in future, an offline map may be introduced to save cost on the internet data plan of the mobile phone.

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