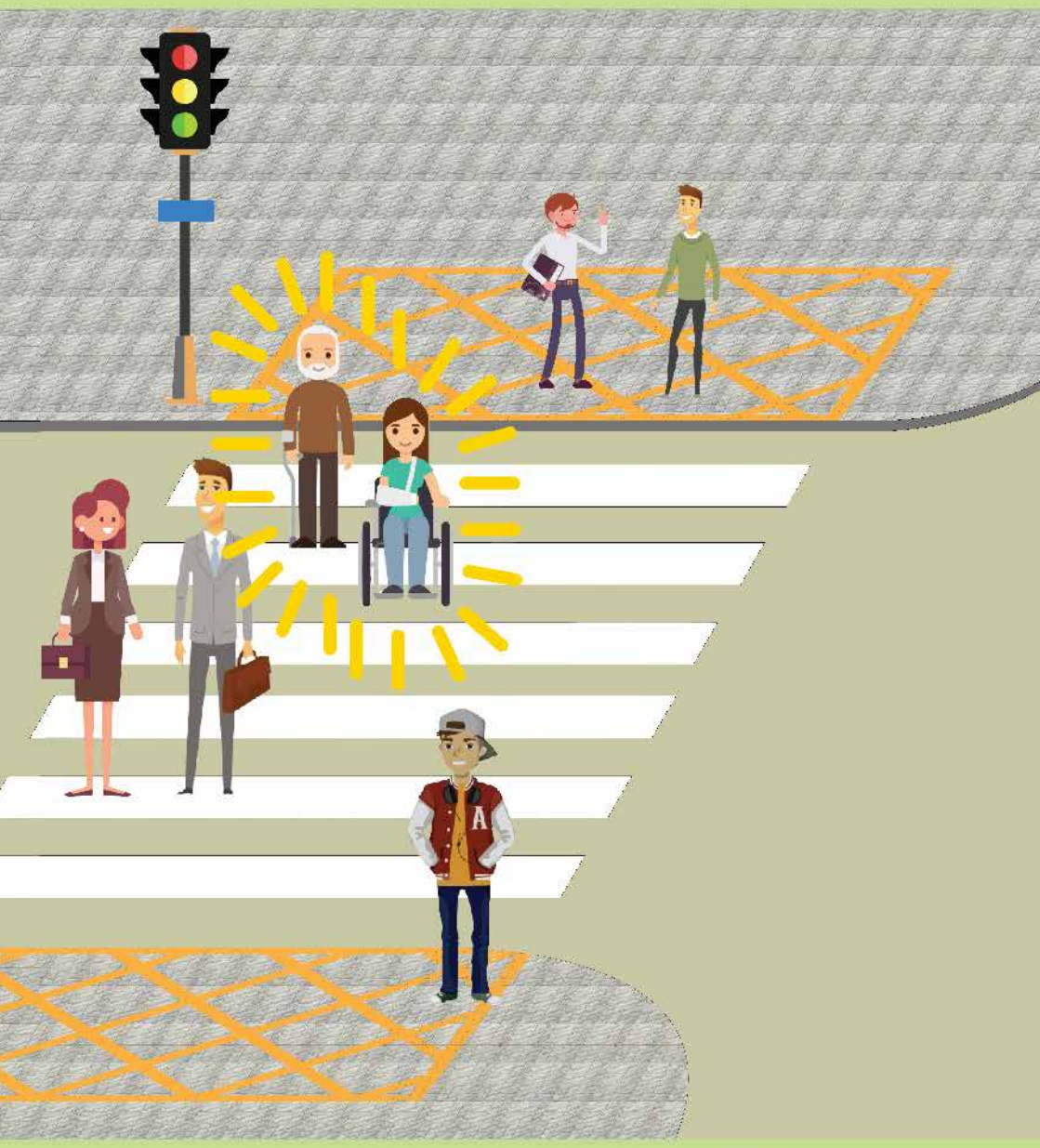
SAFER STREETS



Po Leung Kuk Tong Nai Kan Junior Secondary College

The 51st Joint School Science Exhibition

The Kuk's Spirit

Mutual Respect
United Effort
Benevolence
Charitable
Gratefulness and Recognition

Dedication to Serving
the Community

Vision

Children are nurtured, Youngsters are educated
Adults are supported to contribute
Elderly are cared for
The less fortunate are lightened with hope.

Mission

To be the most prominent and committed charitable organization.
In the Kuk's Spirit to do good deeds with benevolence.
Dedicated in protecting the young and the innocent,
caring for the elderly and the underprivileged,
aiding the poor and healing the sick,
educating the young and nurturing their morality,
providing recreation to the public, caring for the environment,
passing on the cultural inheritance and
bringing goodness to the community

Values

Fine traditions, Accommodate the current needs
People-oriented, Care and appreciation
Sound governance, Pragmatism and innovative
Integrity, Vigilance
Optimal use of resources, Cost-effectiveness
Professional team, Service with heart

保良精神

相互尊重
團結合力
延展愛心
行善助人
感恩知德

造福社群的奉獻精神

願 景

幼有所育，少有所學，壯有所為，老有所依，
貧寡孤困殘病者皆有所望

使 命

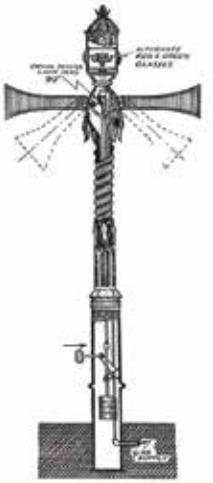
成為最傑出，最具承擔的慈善公益機構，
發揮保良精神，以善心建善業，
致力保赤安良，護老扶弱，助貧健診，培德育才，
揚康樂眾，實踐環保，承傳文化，造福社群

價值觀

秉承傳統與時並進
以人為本關愛感恩
優良管治務實創新
廉潔奉公安不忘危
善用資源注重本益
專業團隊愛心服務

Contents

Introduction



The first traffic light was installed in London in 1868. In 1922, Hong Kong installed the first traffic light at Central. In 1935, the traffic light was re-designed and the same system has been used until now. Traffic lights and Zebra Crossings are the most common types of pedestrian crossing in Hong Kong. We cross the road only when the green light is on and it is very dangerous and even against the law if we cross the road while the red light is on. Using zebra crossings is even more dangerous as there are no lights to indicate when to cross.

We always say "The street is as dangerous as a crouching tiger" Traffic accidents that take place because of traffic lights are common. For example, cars accidentally bump into people may be caused by pedestrians or drivers being distracted. Also the duration of some of the red lights may be too long, or the green light may not last too long due to the limitation of old calculation method. This may result in some impatient pedestrians cross the road even the red light is still on. Or there are disabled and elderly who are lack of time to cross the road. What could be done to stop these types of accidents?

Background

The reasons for choosing this title are to prevent traffic accidents caused by careless behaviors. For example, traffic accidents are caused by distraction of using electronic devices like smartphones. It is very common nowadays as technology is improving and getting more popular. If distracted pedestrians are warned or reminded before they attempt to cross the road, accidents can be prevented. Also, if drivers are reminded about the elderly and the disable are using crossing system ahead, accidents can be prevented. If there is a system that can shorten the waiting time by detecting the number of people who want to cross the road, there will be less people cross the road when the red light is on. Also it can provide extra time for the disabled and elderly to cross the road.

Smartphone applications are easily accessible and widely used now. If we can use an application to notify those who are using the phone while crossing the road, the number of traffic accidents can be minimized.

Objectives and Aims

With Integrated Position System support, a pop-up message could be sent to smartphones by an application (mobile apps). Pedestrians will be notified from a reasonable distance before they cross the road, this can draw their attention.

If smartphone users are using headphones but not looking at their phones, for example, listening to music, they will still be notified. The voice level of the headphones/earphones will be automatically lowered, and a voice reminder will be played, "Pedestrian Crossing Ahead".

Lastly, protecting the elderly and the disabled is also noted as they may not use a smartphone but have difficulty in crossing the road. As everyone should be carrying their Hong Kong Identity Card with the RFID chip added to our new Hong Kong Identity Card, with a detector installed on the crossing light, it can easily locate the people who are crossing the road and if there are elderly or disabled, it will automatically lengthen the crossing time.

Our product aims at reducing the number of traffic accidents at pedestrian crossings caused by some careless behaviors, for example, being distracted or not having enough time to cross the road. Maintaining a safe pedestrian crossing is our concern.

Almost each person uses traffic crossings every day. With traffic accidents happening every day, nobody could deny that it is not common. According to the statistics of the Hong Kong Transport Department, 16099 traffic accidents happened in 2016. About 3000 incidents were cars bump into pedestrians, and 743 pedestrians were seriously injured and 84 pedestrians died.

According to different statistics, traffic accidents caused by distraction of using smartphones have risen significantly.

Also from the statistics of the Hong Kong Transport Department, sorting by the age group of pedestrians in a traffic accident, we found that the group of elderly aged from 80 to 85 has the highest number of casualties which is doubled when compare to younger pedestrians. As we can see, traffic accidents happen much more often to elderly.

Elderly pedestrians	Younger pedestrians
1 in 1000 people	0.4 in 1000 people
2 times more	

With our product, these numbers will go down by tackling the main reasons of causing these accidents. For example, one of our product's functions is to control the duration of the traffic lights.

Positioning System:

The Global Position System (GPS) function is widely used nowadays and it is a built-in function in all smartphones. It allows the smartphone to track the position of the user.

When the smartphone user is near the pedestrian crossing, a pop-up message will be shown to remind users not to get distracted. To avoid annoying the users, pop-up notifications will only be shown when the screen is turned on.

Radio-frequency identification (RFID):

The Hong Kong Identity Card will soon be replaced by a new one which has a RFID chip on it. The traffic light system we are using today has fixed crossing and waiting time. After the RFID system is installed on the traffic light, it will detect the Hong Kong Identity Cards that we are carrying with us. If the pedestrian is an elderly or a disabled person, the system will automatically shorten the waiting time and lengthen the crossing time. Thus, these people should have enough time to cross the road. This will significantly reduce the risk of these people having traffic accidents.

Integrated Positioning System

Global Positioning System (GPS)

GPS is a U.S.-owned utility that provides users with positioning, navigation, and timing (PNT) services. This system consists of three segments: the space segment, the control segment and the user segment. The U.S. Air Force develops, maintains and operates the space and control segments.

Global Navigation Satellite System (GLONASS)

GLONASS is a space-based satellite navigation system operating in the radio navigation-satellite service. It provides an alternative to GPS and it is the second navigational system in operation with global coverage and of comparable precision.

Assisted Global Positioning System (A-GPS)

A-GPS is a system allowing GPS receivers to obtain information from network resources to assist in satellite location.

GPS GLONASS A-GPS

With the help of GPS, GLONASS and A-GPS, the error of the system can be minimized to within 1 meter.

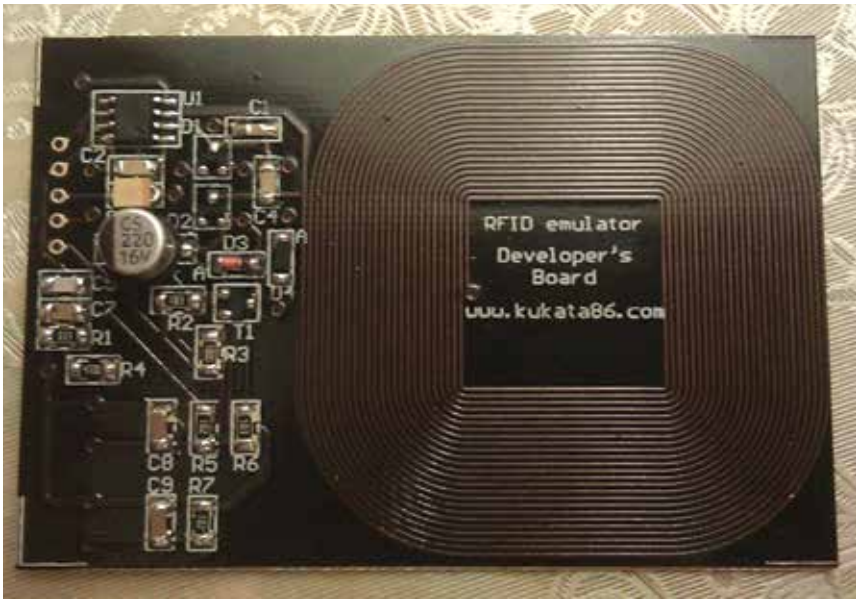
What is Radio Frequency Identification (RFID)?

Ultra-High Frequency (UHF) is one of the frequency bands of RFID and the frequency is around 3.1GHz to 10GHz, it can be detected up to 200m.With the newly designed Hong Kong Identity Card which has the RFID function. It controls RFID that states ISO 14443 which is designed for a range of 2.3m traffic lights to get the pedestrians' information, for example, age and disabilities. This allows the system to adjust the crossing time. If there is an elderly waiting to cross the road, the traffic light will automatically be detected from his or her Hong Kong Identity Card, knowing his or her age, then lengthen the crossing time and shorten the waiting time. This allows an elderly with difficulties to move around to have a safer crossing experience. For privacy issues, all data collected will be erased at once or only be used by the Transport Department for statistics analysis purposes.

Reason for choosing Radio Frequency Identification (RFID)

Our Hong Kong Identity Card will soon be replaced by a new one, which has a RFID chip on it. And our product makes use of this opportunity to develop our system.

- RFID uses radio waves so it doesn't need a line of sight to read the Hong Kong Identity Card
- RFID provides a longer range of reading data.
- RFID can withstand a harsher environment, it is protected by changing bad weathers.
- RFID provides a higher security level.
- RFID can read a couple of data at the same time.



Comparison with other current systems

We have compared ours with other devices and see if they can do the same job. But it turns out that it doesn't work as effective as the RFID and the GPS functions.

Using CCTV and Infra-red cameras will cause a lot of security problems which fail to protect citizens' privacy, for example, pedestrians' faces will be shown.

For the tracking function, using signal emitter instead of GPS will cause a much higher unwanted setup cost.

Device	Infra-red	CCTV	Our System
			
Efficiency	**Low** Can only detect the presence of people but no other useful information.	**Medium** Can only detect people's information with a large AI database.	**High** Can detect the age, gender and the presence of people.
Setup Cost	≈$2000	≈$11000	≈$6000

Device Name	Infra-red	CCTV	Our System
Reliability	**Low** It can be blocked by any solid.	**Medium** It can only provide a limited angle.	**High** It can detect through solid except metal. ☆
Privacy and Security	**Medium** Although people's identities will not be exposed, but their appearance will be recorded and saved.	**Low** CCTV is easy to be hacked and pedestrians' looks and identities will be exposed.	**High** RFID signals are very hard to be intercepted. It will be defined in different authorization. The data collected will only be used for data analysis. ☆
Accuracy	**Low** Other heat-emitting objects will also be detected.	**Medium** It can only provide a limited angle.	**High** The system will only detect the RFID chips on the HKID. ☆

☆ A **Star** represents the best option of every comparison.

In conclusion, our system is the most appropriate one.

Design

Prospect

We hope that our system can prevent traffic accidents caused by common careless behaviors. For example, traffic accidents caused by distractions of using electronic devices like smartphones. It is very common nowadays because technology is improving and getting more popular and at the same time, the number of cars using the road is increasing.

We achieve this by using Integrated Positioning System and RFID technology, which can help users focus on the traffic when near the pedestrian crossing or change the crossing and waiting time. We believe that this can prevent most of the traffic accidents from happening at pedestrian crossings.

In the future, we hope that the Government of Hong Kong Special Administrative Region can adopt our idea and further expand our system into every pedestrian crossing in Hong Kong. This can fully show our product's potential while fully protecting users' privacies. Meanwhile we keep on improving our app and the system and striving for excellence.

Timeline

We had joined The 51st Joint School Science Exhibition with our ideas.

1. Jan 2018
   Applying for the competition
2. Feb 2018
   Researching on the protype
3. Feb 2018
   Preparing for the proposal competition
4. Mar 2018
   Joining The 51st Joint School Science Exhibition Proposal Competition
5. Apr 2018
   Announced 30 schools who can enter the final
6. May-Aug 2018
   Preparing for the exhibition
7. Aug 2018
   Participating in The 51st Joint School Science Exhibition

Participating Schools

ABERDEEN BAPTIST LUI MING CHOI COLLEGE
ABERDEEN TECHNICAL SCHOOL
BAPTIST LUI MING CHOI SECONDARY SCHOOL
BELILIOS PUBLIC SCHOOL
BISHOP HALL JUBILEE SCHOOL
BUDDHIST HO NAM KAM COLLEGE
BUDDHIST LEUNG CHIK WAI COLLEGE
BUDDHIST SUM HEUNG LAM MEMORIAL COLLEGE
C&MA SUN KEI SECONDARY SCHOOL
CANOSSA COLLEGE
CARITAS WU CHENG-CHUNG SECONDARY SCHOOL
CARMEL BUNNAN TONG MEMORIAL SECONDARY SCHOOL
CARMEL DIVINE GRACE FOUNDATION SECONDARY SCHOOL
CARMEL HOLY WORD SECONDARY SCHOOL
CARMEL PAK U SECONDARY SCHOOL
CCC CHUEN YUEN COLLEGE
CCC HEEP WHO COLLEGE
CCC MING KEI COLLEGE
CCC MONG MAN WAI COLLEGE
CHAN SUI KI (LA SALLE) COLLEGE
CHINESE FOUNDATION SECONDARY SCHOOL
CHONG GENE HANG COLLEGE CHRIST COLLEGE
CHRISTIAN ALLIANCE CHENG WING GEE COLLEGE
CLEMENTI SECONDARY SCHOOL
CMA SECONDARY SCHOOL
CNEC CHRISTIAN COLLEGE
CNEC LAU WING SANG SECONDARY COLLEGE
COGNITIO COLLEGE (HONG KONG)
CONFUCIUS HALL MIDDLE SCHOOL
CUHKFAA CHAN CHUN HA SECONDARY SCHOOL
DIOCESAN BOYS' SCHOOL
DIOCESAN GIRLS' SCHOOL
DMHC SIU MING CATHOLIC SECONDARY SCHOOL
ELCHK LUTHERAN SECONDARY SCHOOL
EVANGEL COLLEGE
FUKIEN SECONDARY SCHOOL (KWUN TONG)
FUKIEN SECONDARY SCHOOL (SIU WAI WAN)
GOOD HOPE SCHOOL
GT (ELLEN YEUNG) COLLEGE
HEEP YUNN SCHOOL
HK & KLN CCPA MA CHUNG SUM SECONDARY SCHOOL
HKMLC QUEEN MAUD SECONDARY SCHOOL
HKSYCIA WONG TAI SHAN MEMORIAL SCHOOL
HKTA CHING CHUNG SECONDARY SCHOOL
HKTA TANG HIN MEMORIAL SECONDARY SCHOOL

Participating Schools

HKTA THE YUEN YUEN INT NO.3 SECONDARY SCHOOL
HKUGA COLLEGE
HO FUNG COLLEGE (SPONSORED BY SIK SIK YUEN)
HO LAP COLLEGE (SPONSORED BY SIK SIK YUEN)
HOI PING CHAMBER OF COMMERCE SECONDARY SCHOOL
HOLY FAMILY CANOSSIAN COLLEGE
HOLY TRINITY COLLEGE
HOMANTIN GOVERNMENT SECONDARY SCHOOL
HON WAH MIDDLE SCHOOL
HONG KONG SAM YUK SECONDARY SCHOOL
HONG KONG TANG KING PO COLLEGE
HOTUNG SECONDARY SCHOOL
IMMANUEL LUTHERAN COLLEGE
JOCKEY CLUB GOVERNMENT SCHOOL
KIANGSU-CHEKIANG COLLEGE(SHATIN)
KING LING COLLEGE
KING'S COLLEGE
KIT SAM LAM BING YIM SECONDARY SCHOOL
KWUN TONG MARYKNOLL COLLEGE
KWUN TONG GOVERNMENT SECONDARY SCHOOL
LA SALLE COLLEGE
LAM TAI FAI COLLEGE
LAW TING PONG SECONDARY SCHOOL
LEE KAU YAN MEMORIAL SCHOOL
LEUNG SHEK CHEE COLLEGE
LI PO CHUN UNITED WORLD COLLEGE OF HONG KONG
LIONS COLLEGE
LOK SIN TONG YOUNG KO HSIAO LIN SECONDARY SCHOOL
LUI CHEUNG KWONG LUTHERAN COLLEGE
MA ON SHAN TSUNG TSIN SECONDARY SCHOOL
MADAM LAU KAM LUNG SECONDARY SCHOOL OF HFBM
MARYKNOLL CONVENT SCHOOL (SECONDARY SECTION)
MARYMOUNT SECONDARY SCHOOL
METHODIST COLLEGE
MUNSANG COLLEGE
N.T.H.Y.K. TAI PO DISTRICT SECONDARY SCHOOL
NING PO COLLEGE
NING PO NO.2 COLLEGE
NOTRE DAME COLLEGE
OUR LADY OF THE ROSARY COLLEGE
PENTECOSTAL LAM HON KWONG SCHOOL
PLK CELINE HO YAM TONG COLLEGE
PLK CENTENARY LI SHIU CHUNG MEM COLLEGE
PLK TANG YUK TIEN COLLEGE

PLK YAO LING SUN COLLEGE
POOI TO MIDDLE SCHOOL
POPE PAUL VI COLLEGE
PUI CHING MIDDLE SCHOOL
PUI KIU COLLEGE
QUEEN'S COLLEGE
RAIMONDI COLLEGE
S.K.H. BISHOP MOK SAU TSENG SECONDARY SCHOOL
S.K.H. LAM KAU MOW SECONDARY SCHOOL
S.K.H. LI PING SECONDARY SCHOOL
S.K.H. TSANG SHIU TIM SECONDARY SCHOOL
SACRED HEART CANOSSIAN COLLEGE
SALESIAN ENGLISH SCHOOL

Finalists

Belilios Public School
Fukien Secondary School (Siu Sai Wan)
Good Hope School
Hoi Ping Chamber Of Commerce Secondary School
Homantin Government Secondary School
Kiangsu-Chekiang College (Shatin)
Munsang College
PLK Tong Nai Kan Junior Secondary College
Rosaryhill Secondary School
Salesian English School
St. Mark's School
S.K.H. Lam Kau Mow Secondary School
S.K.H. Li Ping Secondary School
St. Joseph's College
St. Paul's College
St. Francis Xavier's School, Tsuen Wan
Tsuen Wan Public Ho Chuen Yiu Memorial School
TWGHs Sun Hoi Directors' College
Carmel Secondary School
Wa Ying College
Precious Blood Secondary School

The 51st Joint School Science Exhibition








The 51st Joint School Science Exhibition

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Miss Abbie S.K. CHAN & Mr. T.H. WONG

Mr. Sam M.C. CHU

Mrs. Winnie W.L. CHAN

Visitors

Dr. Alson W.K. WONG

Mr. Ben W.C. KWOK

Visitors

Mr. Kenneth C.K. WONG

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