

Overview

Advance Intelligence Traffic Control System (AITCS) is a traffic junction control system that has the ability to think and control different traffic situations and condition without any human assistance needed.

The objective of AITCS is to provide a safer traffic junction, smoother roads traffic and shorten waiting times for road users, determine and provide the best solution or controls for any given traffic condition.

In order for this to be done, a logical program design will be needed to work together with various hardware or equipment to determine every different traffic situations in a split of a second.

The following document is the logical program, system design and the objective of AITCS.

AITCS Logical Program Design and Objective:

- 1. Provide a Safer Traffic Junction**
- 2. Shorten Drivers Waiting Time at Junction**
- 3. Control Any Traffic Junction Condition**
- 4. Authorities Use and Special Operations**
- 5. Vehicle Total Traveling Distance**

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AITCS System Design:

1. This System is design to have various sensor points, Sensor 1 (S1), Sensor 2 (S2), Sensor 3 (S3), Traffic Light Sensor (TS) and Exit Sensor (ES) *Refer to Annex 1*
 - Each sensor point may have multi sensor depend on the number of vehicle lane. And individual sensor will send information captured back to the computer for logical processing.
 - Information capture at each sensor points are such as vehicle speed (VS) and vehicle ID*(VID).
2. Central Brain Unit (CBU), it is computer unit where the logical program installed in and processing all information capture from all sensors. And thus controlling the traffic junction traffic light signals.
3. Traffic light signals control unit. This is an interface unit between the CBU and traffic light signal.
4. CBU backup Unit. This is an auto fail over system in case the main CBU fail due to any reasons, backup unit will kicks in to take over the control.
5. Vehicle ID unit install at all vehicle to identify vehicle identity by the sensors
6. AITCS logical program process captured information from Claim 1 to determine different traffic scenario. Information such as speed of vehicle and vehicle ID, it uses pre-set data such as distance, number of vehicles and time to calculate.
7. A priority traffic or main traffic direction can be input into the AITCS logical program to let the program know which traffic direction have priority during a similar occurrence or calculated result.

8. AITCS backend and remote program use to monitor all AITCS traffic light system. It has the remote function to control and update all AITCS system. This backend program is also a central database to capture and generate reports.
9. AITCS logical program priority list are classified into different priority itself example, Ambulance (Class 1), Fire Engine (Class 2) and Police (Class 3) etc. And in an event when an AITCS junction has all of the 3 emergency vehicles approaching at the same time, AITCS logical program will give priority to Class 1 first follow by Class 2 and Class 3. Classification of could be determine by local authority and changes are allowed if necessary.

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1. Providing a Safer Traffic Junction

AITCS has multiple sensors laid in the traffic direction before a junction. These sensors will detect any approaching vehicle with their driving speed, meters before the junction.

When the system detected an unsafe situation, it will not proceed to turn on the other traffic direction lights to green even if it is time to do.

Scenario

Sensor 1

When junction traffic light is turning RED for east → west traffic, AITCS detected a speeding vehicle XX reached 1st sensor (Appox. 300m away from the junction) at a speed of 160km/h.

The AITCS system will immediately react to calculate if the vehicle is able to stop in time or if the driver has the intention to stop. During this period of time, AITCS will proceed as usual to turn east → west traffic light RED...BUT... holding on to north → south traffic light in RED.

Sensor 2

At the 2nd sensor (Appox. 200m away from the junction) if the vehicle XX is still traveling at 160km/h or above (which means the driver has no intention to stop) north → south junction will remain RED.

If at 2nd sensor the vehicle XX has slowed down to 120km/h, AITCS will calculate if the speed and given distance vehicle XX is able to stop in time or the chance is too low, north → south junction will remain RED.

If the chance of the vehicle is able to stop in time is high, north → south junction will remain RED too until sensor 3 to confirm.

Sensor 3

At the 3rd sensor (Approx. 100m away from the junction)

AITCS will calculate if the speed and given distance vehicle XX is able to stop in time and the speeding vehicle has slowed to a safe speed*

If yes, north → south traffic light will proceed to green.

If No, AITCS will turn on the traffic light camera while it continues to hold north → south traffic light RED.

*Safe speed can be preset in the system to determine if the speeds of any vehicle meet the condition.

Sensor TS

Assuming that there are no other vehicles at the junction:

- 1) Vehicle XX could not stop in time and crossed TS, camera will capture the vehicle number plate for authorities.
- 2) If vehicle XX stopped in time and did not cross the TS sensor or touches the TS sensor, system will deactivate the Traffic light camera.

At this point Traffic light camera will trigger with the following condition:

- 1) Traffic light is red and any vehicle cross the TS sensor

Sensor ES

Assuming that the vehicle XX crossed TS sensor and camera has been triggered, the system will resume back to normal (Turning north → south direction green) when the vehicle have safely passed Sensor ES. This is to ensure that the vehicle has already left the junction and other road users are safe.

If situation is not safe for other traffic direction to proceed, it will hold the supposing green light direction traffic red until the unsafe vehicle:

- i. Crossed the junction (after ES sensor from claim 1 detected the vehicle)
- ii. Stopped (after TS sensor from claim 1 detected the vehicle did not cross the junction)
- iii. Time out period (calculated time that this vehicle will cross sensor ES plus a certain number of time).

In an event when the North-South traffic is on green light and a speeding vehicle is detected by sensor (Claim 1) approaching for the other direction (East-West), AITCS logical program have the function to

- A. Warn the speeding vehicle by flashing its RED light/s or turn on a warning sign.
- B. Turn the North-South direction traffic to RED to prevent accident from happening.

2. Shorten Driver's Waiting Time at Junction

AITCS control traffic junction will turn all direction of traffic light RED after a period of time when there is no vehicle using it.

Reason for all lights to change to RED when is not in use, is to prevent any drivers to see a green light and approach it at higher speed in order to beat it.

As there are multiple sensors laid in any traffic direction before an AITCS junction. These sensors will detect any approaching vehicle with their driving speed, distance before the junction.

Scenario

When a vehicle R (North South direction) is approaching the junction, passing sensor S1, system will capture the speed and with fixed distance, system will immediately calculate the time it will reach the junction (Provided that R is travelling within speed limit).

When system knows the time, it will check and compare with East West traffic direction. If there is no approaching traffic from East West, system will turn on the North South direction traffic light green for vehicle R to pass when R passes sensor 2.

If East West direction also have vehicle approaching, system will compare the time they will reach the junction and turn on the earliest reaching vehicle. And after the earliest vehicle passes the junction, it will turn back to red and turn the other traffic direction to green for the second vehicle to pass.

This shortens drivers waiting time compare to traffic light system, which will be trigger by:

- 1) Timer, driver will have to wait an empty traffic light junction for his/her turn to pass.
- 2) Sensor at the traffic light junction, drivers have to come to a halt completely and

accelerate to move off again.

3) Combine of 1 and 2

The entire above not only wasted precious time which is not necessary, it also wastes a lot of fuel. ***Part of going Green depends on how we use our fuel more efficiently.***

This is not to encourage speeding, who reach the junction first, who will cross the traffic junction first.

There will be a safety protocol for speeding vehicles, system take travelling speed into first requirement, any vehicles that are traveling above the stated speed limit, system will remain RED even the speeding vehicle timing to reach the junction are earlier than others.

System will in another word force the driver to slow down by remaining RED lights at his/her direction; of course it will also take into consideration of other direction traffic safety by holding their lights too, just in case the speeding driver did not decide to stop or could not stop in time.

This is a safety feature in part 1, **Providing a safer traffic junction**

System will change to green only when the speeding vehicle reduces its speed to the desired range or stop at the junction.

Example of how the system will be designed.

Sensor 1 (Distance 300m), Vehicle R ID, Speed capture = XXkm/h

System will check:

- 1) Within speed limit*
 - a. Yes, Proceed to (2)*
 - b. No, Proceed to (A)*
- 2) Check the other direction of traffic, if there are any approaching vehicle*
 - a. Yes, Proceed to (i)*
 - b. No, Proceed to (3)*

3) *When vehicle reach next sensor, turn traffic light to GREEN*

A) *System to hold RED light, capture the speed again at next sensor and Proceed to (1)*

i) *Compare which vehicle will reach traffic junction first and turn that vehicle Traffic light green when vehicle reach next sensor.*

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3. Control Any Traffic Junction Condition

AITCS logical program method of controlling any traffic junction condition, by using part 2, **Shorten Driver's Waiting Time at Junction** adding in the following features

- Priority traffic direction (Example: North-South direction)
- Maximum waiting time (Example: North-South 60secs and East-West 90secs)
- Maximum number of vehicle to cross the junction

With the above **Shorten driver's waiting time at junction** function and the combine of the feature of the above.

In an AITCS junction the system knows the number of vehicles that are in the junction area (from sensor S1 to sensor TS) and even before the maximum waiting time have reach, the system may turn the heavier traffic direction lights to green earlier. AITCS will use vehicle count and waiting time to control the traffic condition.

Example, during peak hours, when all directions are equally heavy, AITCS will use priority traffic direction to determine which direction will be given more vehicles to cross the junction. But if due to some circumstances if the given green light direction traffics could not reach the count, timing will kicks in to turn the lights red and continue with other directions.

AITCS will continue to monitor all traffic direction traffic flows, if any side of the traffic have lessen, system will automatically give more priority to heavy traffic direction by giving heavy traffic direction more time or lessen the green light time at lesser traffic direction.

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Another AITCS logical program method of controlling any traffic junction condition is by using past traffic statistic and / or captured traffic statistic to control the AITCS junction.

AITCS has the features to input a recorded statistic of vehicle traveling across the junction in all direction in different timing. AITCS will use this input to auto control the traffic flows during peak hours or during traffic congestion.

Example: Human can do a physical count of the vehicle on crossing this junction from 7am to 9am. During this time, there are 20 000 vehicles traveling in north-south direction and 15 000 vehicles traveling east-west direction.

Once the AITCS has this information, during the 7am – 9am period, it will automatically give more priority to north-south direction and monitor the vehicle counts and waiting time.

Beside a feature to input a recorded statistic, AITCS logical program can capture the traffic statistic itself and learn from the capture statistic to automatically adjust the traffic timing to the detail level of month, day and time. And AITCS will base on the captured statistic to control the traffic and regulate heavy traffic situation.

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4. Authorities Use and Special Operations

Since AITCS system design have the function for capturing vehicle details from the equipment installed below a vehicle. System can be design to accept a list of vehicle details and let the system give priority to them for any traffic condition.

- 1) Usage for Emergency Vehicles
- 2) Special Operation Usage

Usage for Emergency Vehicles

Emergency vehicles such as Ambulances, Fire Engines, Police etc... All these vehicles will definitely have a same vehicle ID unit like all other vehicle and what make the system recognize these vehicles during emergency is that they will install an additional unit to the vehicle.

How does this work, during non-emergency time, these emergency vehicles will be treated as normal vehicles travelling on the road, during emergency, when the sirens is switched on, the ordinary vehicle ID unit will be switch off and another vehicle ID (E) will be switch on*.

This set of vehicle ID (E) is listed under AITCS priority list and when any traffic sensors pick up this set if vehicle ID (E) approaching a AITCS junction, it will automatically turn all traffics lights to RED and only the emergency vehicle travelling direction to GREEN to let the emergency vehicle pass the junction quickly.

System will return to back to normal function mode after the Emergency vehicle have crossed the junction and passed any sensor ES.

*Refer to the above **

Vehicle ID: QX1234G (During non-emergency patrol)

Vehicle ID: EQX1234G (During Emergency)

This is subjected to changes and technology available, further researches are needed to be made.

Special Operation Usage (SOU)

Uses for Special Operation meaning, VIP escort or Similar functions

During VIP escort from one destination to another, there will be escort bikes in the front and the rear of the convoy. We can program the AITCS system to register which bike is the front escort, so once the front bike travel passes any sensor before a traffic junction, it will capture the vehicle ID and automatically turn all traffic directions lights to RED and only the front escort bike travelling direction to GREEN

After the convoy has crossed the junction the system will capture the rear escort bike vehicle ID and return the traffic junction to normal function.

For the SOU, there are points to note, front escort bike must always be in the front and the rear escort bike must always stay at the rear at all times.

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5. Vehicle Total Traveling Distance

When this AITCS is fully implemented across all traffic junctions, we are able to calculate a vehicle estimated traveling distance per day/month/year.

This could be done because every time a vehicle passed through an AITCS traffic junction, its “vehicle ID” is captured. And from one AITCS to any other AITCS traffic junction the distance can be already measured and input into the system thus AITCS can calculate the total distance a vehicle travelled.

With multiple sensor to capture a “vehicle ID” in a junction, it would be hard to miss. Even is any AITCS traffic junction breakdown, it does not affect the distance calculation because when the vehicle passes another AITCS junction, the distance is still known.

This data could be store in local traffic junction CBU and transmit back to HQ in real time or in delayed time if the communication network are not available or down due to any weather condition or unforeseen circumstances. This is also to ensure no data/ minimum data lost.

And from HQ system, it can generate reports base on individual vehicle total travelled distance for the day/month/year. And this report can be used for other meaningful purposes.

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