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Wifi-Direct Ad Hoc Network for Preventing Road Accidents

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Abstract: *Mobile Ad hoc networks have been used in various applications. Its attractive features are its decentralized nature and less infrastructure need. Wifi-direct can be used in mobile adhoc network which is a Wi-Fi standard enabling devices to easily connect with each other without requiring a wireless access point.[1] Assurance of road safety using new technology of Ad hoc mobile network is a developing research topic all over the world. In this paper, Wifi-direct Ad hoc network is used to ensure road safety .One key feature of Wi-Fi Direct is the ability to connect devices even if they are from separate manufacturers. Only one of the Wi-Fi devices needs to be compliant with Wi-Fi Direct to establish a peer-to-peer connection that transfers data directly between them with no additional setup while establishing connection to new vehicle. In the proposal it has been shown that interaction of Wifi direct Ad hoc network with electrically controlled engine unit will prevent accident by stopping the car automatically at safe distance between two face to face vehicles.*

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I. Introduction

Since Wifi-direct Ad hoc network devices connect with each other without requiring a wireless access point it can be put on each vehicles to connect and get data from nearby vehicles. Each vehicle in the system would be installed E.C.U(Engine Control Unit) which will receive data from Wifi enabled microcontroller. Based on data provided by microcontroller, sensors of E.C.U will reduce speed of vehicle by providing less fuel/energy to the engine.

Architecture of the system

Wifi direct Architecture

Wifi-direct is a peer-to-peer connection which is controlled by Application Session Platform.The Application Service Platform (ASP) can be defined as a logical entity that implements the common functions needed by various services. These functions are: device discovery, service discovery, ASP session management, connection topology management, and security.

An ASP session is a logical link between the ASP on one device and the ASP on another device. An ASP session requires a P2P connection between peer devices in order to start. An ASP may set up multiple ASP sessions between two devices. Each ASP session is identified by a session identifier (session ID) assigned by the ASP requesting the ASP session. Here in the following figure sequence of operations in wifi-direct is shown .[2]

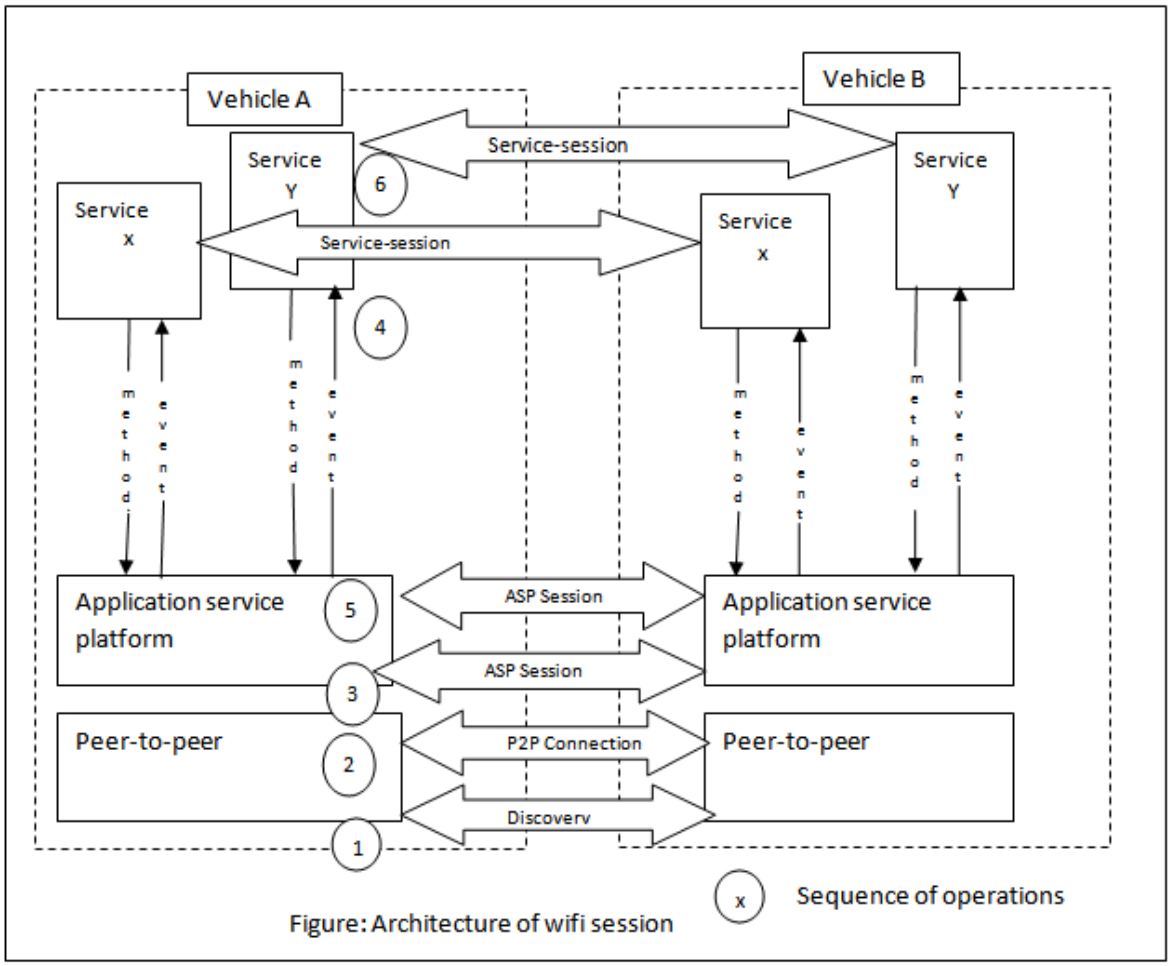

Figure: Architecture of wifi session

In the figure the real time scenario is explained. At first whenever two vehicles will be in close range, there will peer-to-peer discovery. Then P2P connection will be established. ASP session would be created which will be responsible to provide session for microcontroller which will measure the distance of two nearby vehicles.

The precedence of operation will be in the following order:

1. Discovery
2. P2P connection
3. ASP session set up for service X
4. Service X service session configuration
5. ASP session set up for service Y
6. Service Y service session configuration

Here, An ASP coordinates the discovery of services and manages the connections and sessions between two P2Ps enabled devices.

E.C.U

An **engine control unit** (**ECU**), also commonly called an **engine control module** (**ECM**), is a type of electronic control unit which controls a series of actuators on an internal combustion engine to ensure optimal engine performance.[3]

E.C.U.s consists of a microcontroller which can process the inputs from the engine sensors in real-time. An electronic control unit contains the hardware and software (firmware). The hardware consists of electronic components on a printed circuit board (P.C.B.).The main component on this circuit board is a micro controller chip (CPU). The software is stored in the microcontroller or other chips on the P.C.B., typically in EPROMs or flash memory so the C.P.U. can be re-programmed by uploading updated code or replacing chips. This is also referred to as an (electronic) Engine Management System (E.M.S.).

Proposed system with Wifi-direct

In the proposed system wifi direct will be in a P2P(point to point) framework consists of components that will interact to support interoperable services between two vehicles. It is the main connectivity will occur between p2p devices.There will be secondary services of roadside towers which will also receive information from nearby vehicles.

E.C.U will work on different stages of the combustion engine. When it needs to reduce the speed of the vehicle the sensor of engine will work at four different stages of the internal combustion engine so that the vehicle will stop automatically in order to avoid accident.

Every near approaching vehicle will get the other vehicles data from wifi signal. Microcontroller will calculate the near approaching vehicle data from wifi sensors.

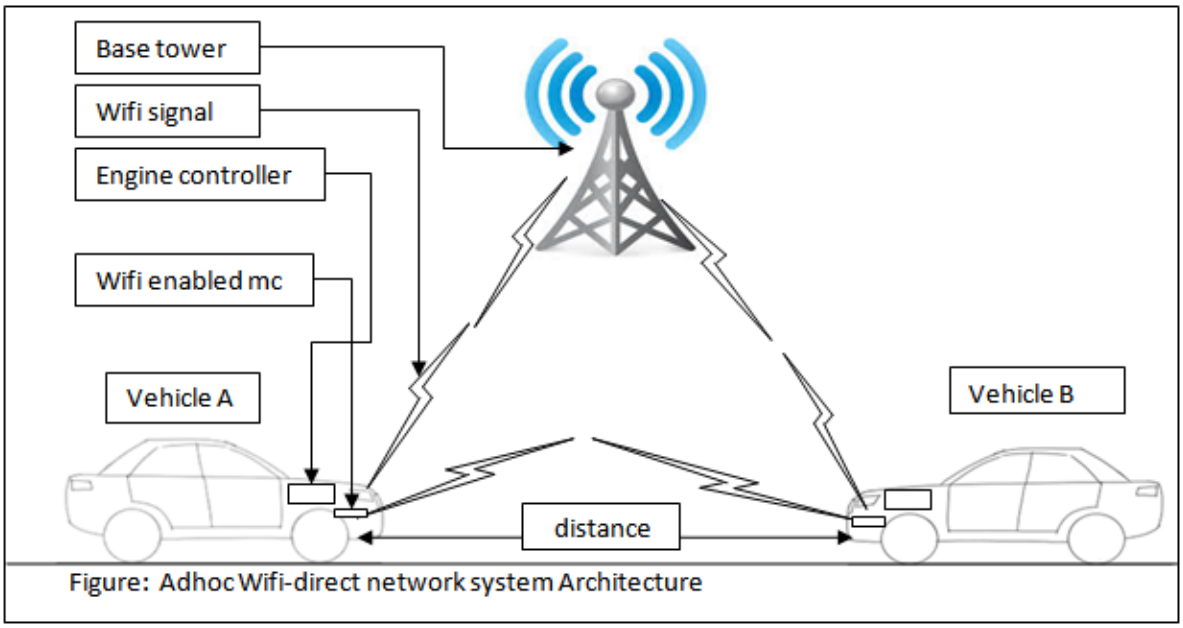

Figure: Adhoc Wifi-direct network system Architecture

Finding the distance

Free Space Path Loss equation calculates the loss (in dB) between two antennas where the gain, distance and frequency are known.

Free Space Path Loss, FSPL(Db)=20log10(d)+20log(f)+k

Here,

d=distance

f=frequency

k=constant that depends on the units used for d and f

For d, f in meters and megahertz, respectively, the constant becomes -27.55.[4]

Here at first, frequency of each wifi-direct device is measured and recorded in the micro-controller. E.C.U will get the data from micro-controller with the help of above equation and it's sensor will provide signal to the engine through which vehicles in close range will reduce speed and halt if needed.

Engine management system, E.C.U after receiving inputs from Wifi-direct it will control other parts of the engine; for instance, some variable valve timing systems can be electronically controlled, and turbocharger waste gates can also be supervised. They also may communicate with transmission control units or directly controlled automatic transmissions through E.C.U, traction can also be controlled by system which will also help to reduce speed of the vehicle in the time of emergency. The roadside tower is often used to achieve communication between these devices.

II. Conclusion

Road accidents can be reduced significantly if the system can be implemented. In a developing country like Bangladesh where highway roads are very much accident prone due to huge amount of traffic in limited roads; it can save hundreds of lives.

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