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Android in-Vehicle Infotainment System

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Abstract: *In this modern age automotive industries are changing and updating in rapid ways as in term of engine performance and in terms of safety, economic and efficient way of transport. In this paper we are proposing an idea to build low cost car infotainment system based on android. These would help user to drive safely and efficiently. The infotainment system will run on ARM SOC with special in modified UI and api as per automotive software requirement. This system will get input from various hardware and sensors like accelerometer, proximity, OBD, temperature, humidity sensor, TPMS etc, with GPS and internet service ready. This system will be built fewer than 15 thousand rupees which will give features of luxury car to mid-low range of vehicle. This system will be based on open source android with third party application support. This system will also provide vehicle tracking, monitoring and diagnosis from remote location.*

Keywords: *Android car infotainment system, engine diagnosis, monitoring, security, GPS.*

1. INTRODUCTION

In this modern age the technology is moving fast and we have seen that any new technology introduced will be offered at high price. If we elaborate this any new technology is first introduced in high segment of car than it is used in lower segment car later on. The idea, what is been proposed is to give lower segment of car the new technology & feature at low cost. The features will include GPS navigation, accelerometer, TPMS, proximity, reverse camera, engine diagnosis, multimedia HD content, gas sensor, other device attachment, etc.

Android will support all this hardware and sensor, including raw data coming from ECU. When focusing on mid range cars which covers 90 percent of population in India, the user is only given features worth his money which is analogue and manual system.

2. IN VEHICLE INFOTAINMENT SYSTEM

IVI system such as BMW's I-drive, Audi's MMI and Alpine after market solution has been primary application platform to provide interactive automotive features till now. IVI systems are integrated into the car and provide all in one solution car infotainment and drivers friendly display and control. This IVI systems are factory fitted and cost more, so this IVI are not feasible for mid segment car.

2.1 Android Car Infotainment

As monition, we are proposing a low cost car entertainment system for low-mid segment car and vehicles, with android as open source platform. The system will include hardware as...

1. Dual core arm cortex-v8 SOC
2. GB NAND storage
3. 1 GB RAM DDR2
4. Wi-Fi / Bluetooth
5. 7" display, capacitive touch
6. GPS
7. Tyre Pressure Sensor

8. Reverse Camera
9. SATA HDD support
10. HDMI
11. Wireless Display (Miracast)

2.2 Existing System in Cars

The existing system in mid range car, the display are analogy for speedometer, tachometer and other indicators, like car malfunction with some engine fault are indicated by a light blinking. Driver cannot rely on light indication for malfunction in car, where as car ECU sensor can help to get detail fault of car engine through OBD. Also the mileage for the car can be only calculated manually in mid range car.

2.3 Disadvantage of Existing System

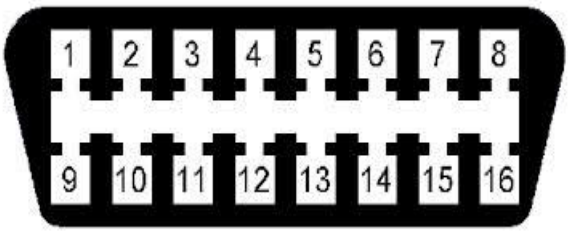
There are many disadvantages some are as follow.

1. Infotainment system cannot upgrade due to proprietary and close source.
2. Analogy output data
3. Values are not accurate
4. ECU can provide many sensor output but no device to read or diagnosis it.

3. ON-BOARD DIAGNOSIS (OBD)

It refers to self diagnose and reporting capabilities port. It is used to access physical engine and subsystem status. The early version of OBD in 1980's would simply illuminate a indicator light if possible was detected but could not provide detailed information of the problem. Modern OBD use a standard diagnostics digital communication port to provide real time data in addition to a standardization series of diagnosis trouble code (DTC), which allow to rapidly identifying malfunction within the vehicle. In Indian market after 2006 OBD II standard is used.

PIN	Discription	PIN	Discription
1	Vendor Option	9	Vendor Option
2	J1850 Bus +	10	J1850 Bus -
3	Vendor Option	11	Vendor Option
4	Chessis Ground	12	Vendor Option
5	Signal Ground	13	Vendor Option
6	CAN (J-2234) High	14	CAN (J-2234) Low
7	ISO 9141-2 K-Line	15	ISO 9141-2 L-Line
8	Vendor Option	16	Battery Power



OBD II Pins

The OBDII connector is required to be within 2 feet of steering wheel, some vehicle has OBD port below the steering wheel or in dash board.

2.4 OBDII

Functions:

1. Read diagnostic trouble codes, both generic and manufacturer-specific, and display their meaning
2. Clear trouble codes and turn off the MIL ('Check Engine' light)

3. Display current sensor data
4. Engine RPM
5. Calculated Load Value
6. Coolant Temperature
7. Fuel System Status
8. Vehicle Speed
9. Short Term Fuel Trim
10. Long Term Fuel Trim
11. Intake Manifold Pressure
12. Timing Advance
13. Intake Air Temperature
14. Air Flow Rate
15. Absolute Throttle Position
16. Oxygen sensor voltages/associated short term fuel trims
17. Fuel System status
18. Fuel Pressure

4. GPS NAVIGATION

An automotive navigation system is a satellite navigation system, designed for use in automobiles. It typically uses GPS module to acquire position data to locate the user on a road in the map. Using the road database, the unit can give directions to other locations along with roads route. The GPS receiver used in this system is high power 50 channel, 1.5 GHz with accuracy of 2.5m. The GPS receiver TTFF (Time to First Fix) Hot starts 1s, Cold start 27s.

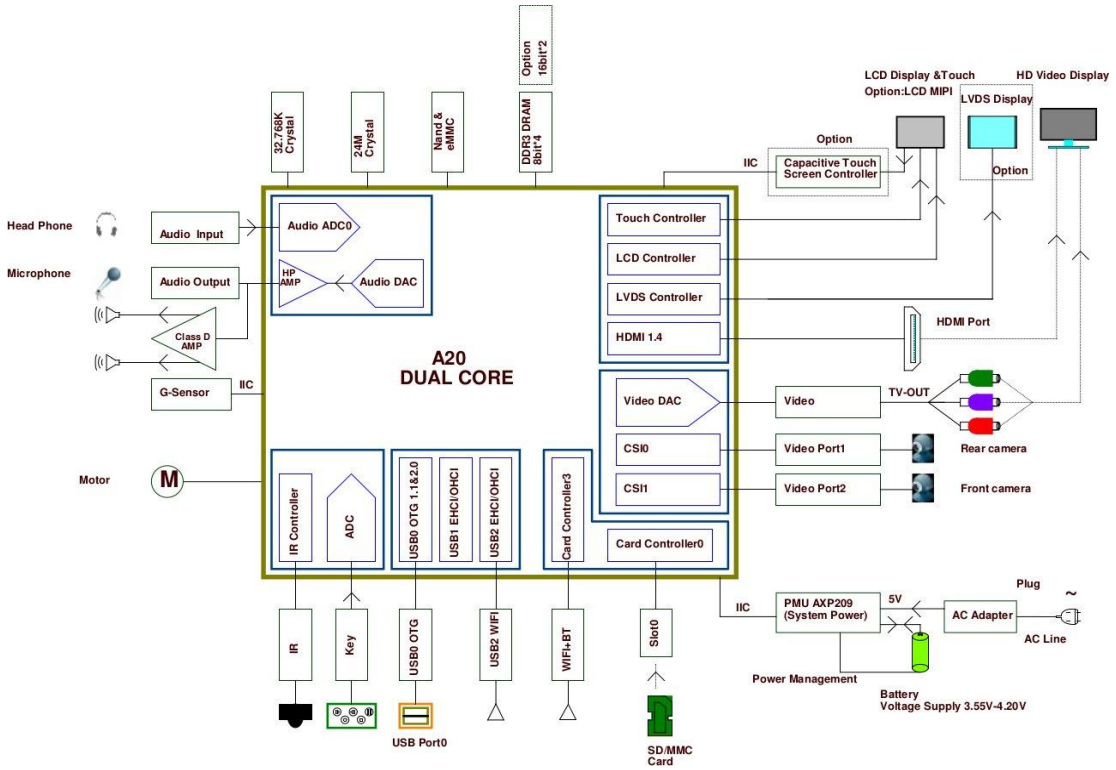
5. SENSORS

The sensor in the car allows the driver to monitor real-time environment data. Distance sensor will help in car parking. TPMS (Tyre pressure measuring sensor) will monitor the tyre temperature and pressure to improve tyre life. This sensor data provide accurate data which will let end user maintain and extend the life of the vehicle.

6. SOFTWARE APPLICATION

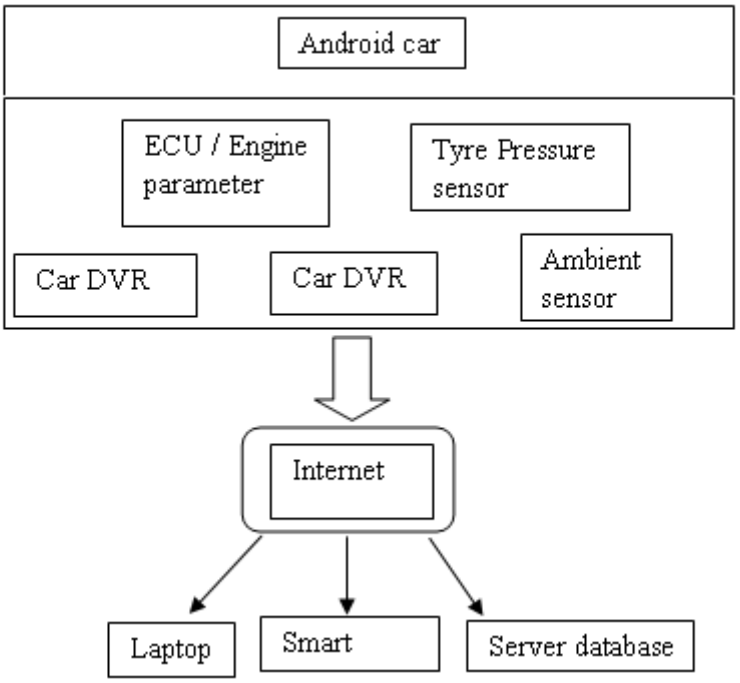
The system we are proposing that has number of applications which help user to make better use of the car in ways of security, entertainment, information as well as use of specially modified API for building car application. Android is best suited for the IVI system as it is open source, all the API modification app building for car IVI can be achieved easily. Android also provide voice control and voice recognition system using Google Speech Engine API which will allow user to control system with voice command. The speech synthesizer

Text-to-speech and speech-to-text helps user to send text message with voice input which will avoid distraction while driving. As android is open source any new hardware can easily be ported to the system with AOSP (Android Open Source Project) provided by Google. Apart from Android as operating System for integration of new hardware and sensor there is need for modification of Linux kernel. Android is based on Linux kernel.



7. CAR DATA LOGGER

As we mention the system will also be use for tracking and monitoring purpose. There is importance of black box in aeroplane to diagnosis the cause of crash, here in car data logger uses same methodology and also to track the performance of the car with the position. The fig. shows the block working and data logging concept.



8. CONCLUSION AND FUTURE WORK

Our research led to the implementation of an Android-based In-vehicle Infotainment system (AIVI) that addressed some of the shortfalls and challenges faced by the infotainment systems of today.

Currently the system has the following features:

8.1. Completed

1. Complete Android operating-system running version 4.2.2 (Jellybean)
2. Ability to run any Android third-party application compatible with version 4.2 and below.
3. 7-inch touch-screen
4. 3G modem and 3G internet connection via USB dongle
5. GPS turn-by-turn navigation
6. A custom application specifically designed for in-vehicle use made particularly for the larger AIVI display area (7-inch screen).
7. OBD/ECU parameter on Android

8.2. To Do

1. Temperature Sensor Integration
2. TPMS- Tyre Pressure Management Sensor
3. Reverse Camera

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Gaurav Jaiswal has completed BCS from Vivekanand College Aurangabad. Now he is pursuing MCA from MIT College Aurangabad. Although a student, keen into research and development. So working on Open Source platform like Linux and building Android for new devices. Also working at GIGIL TECHNOLOGIES (Software solutions, embedded system)