

# MOBILE CLIENT DEVICES AND PERVASIVE COMPUTING

## Lesson 07

### Automotive System Devices

# AUTOMOTIVE SYSTEMS SINCE 1960s

- Extensive use of computing and processing units
- Car engines control,
- automobile stability,
- transmission and braking processes

# RECENTLY REVOLUTION IN AUTOMOTIVE SYSTEMS

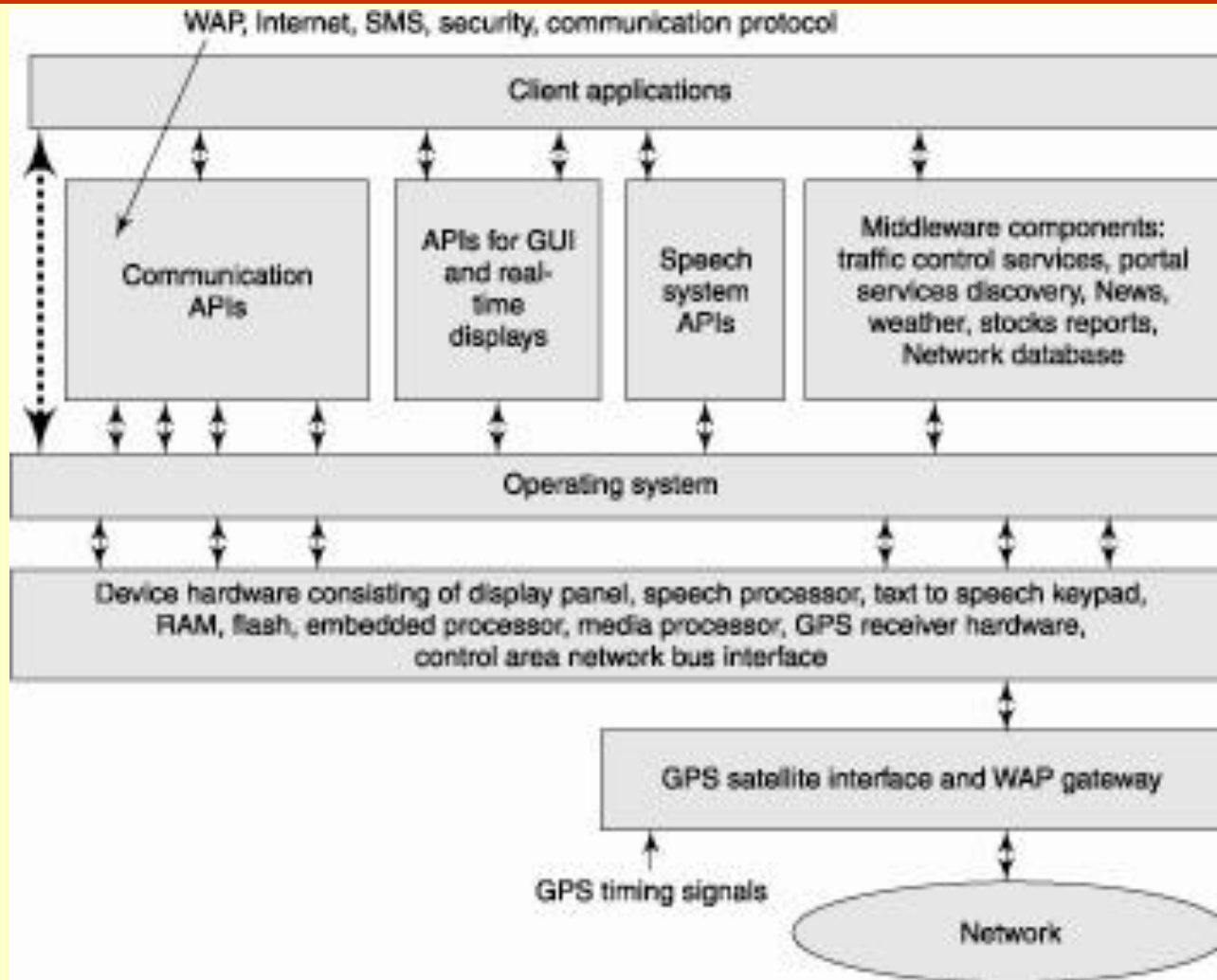
- Sophisticated information oriented technology
- Reverse sensing and night vision
- Communication systems
- Voice initiated controls
- driving comfort and ease

# RECENTLY REVOLUTION IN AUTOMOTIVE SYSTEMS

- GPS map based navigation using Traffic congestion on-line information
- Speech Recognition
- Smart card security control
- Collision avoidance sensors

# MOBILE COMPUTING

## ARCHITECTURE IN AN AUTOMOBILE



# PROGRAMMING LANGUAGES

- Use Java, ASP, and JSP for web based applications and retrieval of data from databases at various portals
- For example, while driving towards the airport a user can retrieve flight information from the airline's portal

# SPEECH RECOGNITION SYSTEM (SRS)

- Automobile start by the driver's commands after recognizing their voice through the SRS
- Application software can be programmed such that the driver can command the automobile to halt, maintain the current speed, or stay under a given speed limit
- The SRS uses a digital signal processor

# MESSAGING SYSTEM

- HTTP through Wi-Fi or WAP (wireless application protocol) device through Mobile Service Provider in an automobile enable connection to the Internet and then to servers and clouds
- A service provider can transmit, in real time, the news, weather data, and stock reports.



# TRAFFIC REPORTS SYSTEM

- Traffic control service sends traffic reports
- Automobile owner can subscribe to a traffic control service provider which provides SMS messages about traffic slowdowns and blockages at various points in the city

# TRAFFIC REPORTS SYSTEM

- Traffic messages then converted to speech using a text to speech (TTS) converter software and can be heard by the driver
- It enables the driver to select roads that will provide a faster, hurdle-free passage

# TEXT TO SPEECH (TTS)

- Use C in Linux for converting an SMS text to speech (TTS)
- Driver need not divert their attention to read the text on the display panel
- Can, instead, listen to the received message while driving

# ANTI-COLLISION SYSTEM

- Warn the driver if the automobile gets too close to another
- Also sense objects which are not visible to the driver using a laser, infrared, or RADAR system
- Collision avoidance systems take control of the vehicle to avoid colliding with other objects

# GLOBAL POSITIONING (GPS) SYSTEM

- Also called geographical positioning system)
- Automobile can be fitted with GPS receiver
- Receives signals transmitted by various GPS satellites orbiting the earth
- Timing circuits of all satellites are in synchronization
- Each signal carries this time information

# GLOBAL POSITIONING (GPS) SYSTEM

- Let us assume that the time information from the  $i^{\text{th}}$  satellite is  $t_{0i}$
- Each satellite signal will have a different value for  $t_{\text{direct}}$
- $t_{\text{direct}(i)}$  for the  $i^{\text{th}}$  satellite
- Receiver will receive the signal at time  $t = t_{0i} + t_{\text{direct}(i)}$
- Reads  $t_{0i}$  from the time information in the signal

# GLOBAL POSITIONING (GPS) SYSTEM

- Calculates  $t_{\text{direct}(i)}$  from  $t$  and  $t_{0i}$ .
- At an instant, at least three GPS satellites are in view of any location on the globe.
- The values,  $t_{\text{direct}(i)}$ ,  $t_{\text{direct}(j)}$ ,  $t_{\text{direct}(k)}$ , ..., for the  $i, j, k, \dots$  satellites give the present geographical position of the automobile

# GEOGRAPHICAL POSITION MESSAGE

- Geographical position continuously marked on a map on a display-panel
- Helps the driver in choosing the right path to the destination
- A data-to-speech converter application software can also be used to speak aloud the name of the current position



# APPLICATION PROGRAMMING FOR THE POSITION AND CHANGES IN THE MAP

- Use GTK (graphic tool kit) language or C in Linux for drawing, in real time, the road map on the display panel with the automobile's position suitably marked on the map on a real-time basis
- Changes the map on the screen in case the automobile moves into another zone
- Continuously shifts the marked position as the automobile moves

# AUTOMOBILE START AND MALFUNCTION LOGINS

- Smart card or smart token to start the automobile
- The card inserted into the host not only starts the car but also logs the data for the malfunctions recorded during driving.
- At the service workshop, a card reader reads the card and retrieves the logged data as well as the service history details

# AUTOMOBILE MALFUNCTION LOGINS

- The workshop can render a more efficient service using this information
- The service provider's PC writes the details of the service provided onto the card memory for future reference
- JavaCard used for developing the start and malfunction logging applications

# SENSOR AND ACTUATOR PROGRAMMING

- Number of sensors and actuators
- For example, pressure sensors
- Sensors communicate, to the display panel, warnings about tyre pressures
- Sensors and actuators connect to the CAN bus

# ENTERTAINMENT SYSTEMS IN AUTOMOTIVE

- A number of entertainment systems, for example, FM radio, media players to play Wave (WAV), RealAudio (RA), and MPEG-1 Audio Layer 3 (MP3) files
- Programs for downloading music from the Internet in formats such as WAV, RA, and MP3 using a WAP gateway

# ENTERTAINMENT SYSTEMS IN AUTOMOTIVE

- A USB port can be used to download files from another system.
- A Bluetooth device used to download data from PDAs, smart phones, and pocket PCs

# REAL-TIME APPLICATIONS

- Windows 8.1 Phone OS functions for the multiple threads and networking and communication protocol APIs
- Real-time applications for the Java platform can also be developed using OSEK

# SUMMARY

- Automotive systems
- Collision control
- Messaging systems
- TTS
- GPS, position and maps on screen
- Traffic reports
- Malfunction logins



**End of Lesson 06**  
**Automotive System Mobile Devices**