Bluetooth Controlled Vehicle

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Overview

- Introduction
- Background
- Analysis
- Tasks
- Deliverables
- Demonstration

Introduction

- Objective
  - Multipurpose vehicle framework
  - Bluetooth powered device
  - Simple API
- Purpose
  - Military
  - Commercial

Background

- Bluetooth
  - Implement a universal standard
  - Frequency-hopping spread spectrum
    - Gaussian frequency-shift keying (GFSK)
  - 2.4 GHz short-range radio frequency
  - Class 1, Class 2, Class 3
  - 1 Mbit/s on version 1.2
  - 3 Mbit/s on version 2.0 + EDR

Background

- Android
  - Mobile Operating System
    - Linux Kernel
  - Kernel 2.6.29 (2.1)
  - Robust SDK
  - Bluetooth 2.0
  - Java programming
  - ARM Native Code

Analysis

- Hardware
  - Set of DC Servo motors
  - Optimal power supply
  - Expandable frame
  - Integrated microcontroller
  - Wireless capabilities

Item	Cost
RC Test Vehicle	$189.95
Bluetooth modem	$64.95
Total Cost	$254.90

Analysis

- Software (Vehicle)
  - Bluetooth integration
    - Keyboard profile
    - Interpret remote signals
  - Digital control of analog DC motors
  - Speed sensor and steering
  - Traction control

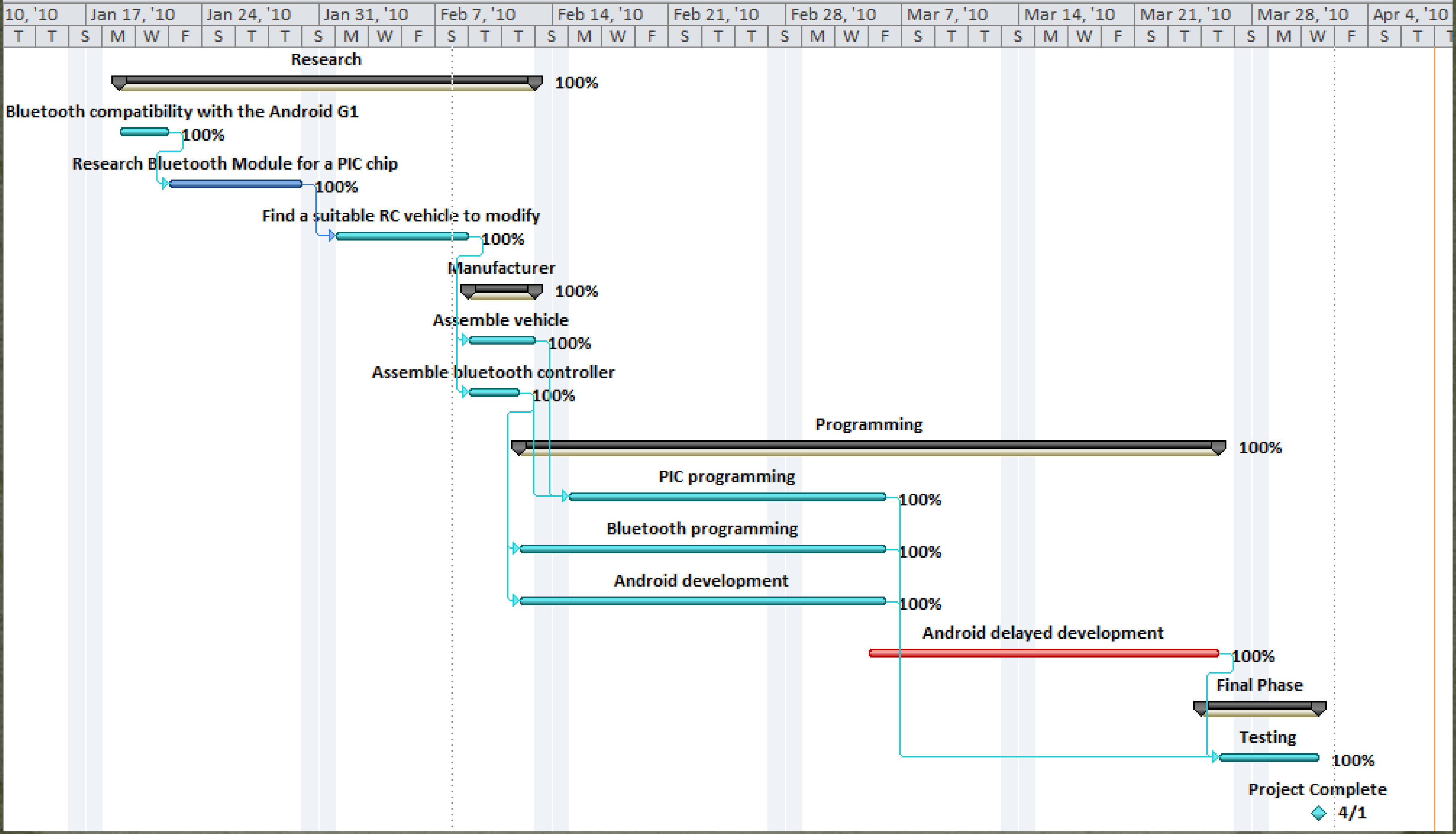
Analysis

- Software (Remote)
  - Android application
  - Windows integration
  - Bi-directional communication
    - Report speed
    - Error conditions
    - Display speeds
  - Speed control

Tasks

- Research
  - Bluetooth module
  - Operating systems
- Programming
  - Bluetooth connection
  - Android application
  - PIC C programming
- Testing
  - Multiple controllers

Tasks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Research 100%
Bluetooth compatibility with the Android G1 100%
Research Bluetooth Module for a PIC chip 100%
Find a suitable RC vehicle to modify 100%
Manufacturer 100%
Assemble vehicle 100%
Assemble bluetooth controller 100%
Programming 100%
PIC programming 100%
Bluetooth programming 100%
Android development 100%
Android delayed development 100%
Final Phase
Testing 100%
Project Complete 4/1

Tasks

- Microcontroller Integration
  - Wire control and signals
  - Process signals from vehicle (motor speed)
  - Framework for control, feedback, and expansion

- Bluetooth Integration & Remote testing
  - Allow seamless unattended pairing
  - Process BT keyboard signals
  - Test with multiple devices
  - Simple application for cellular phone

Deliverables

- Fully functional RC vehicle supporting 4 directions of travel
  - Forward, Reverse, Left, Right
- Bluetooth remote control
  - Regular keyboard over Desktop
  - Android application
    - T-Mobile G1
    - Verizon Droid

Deliverables

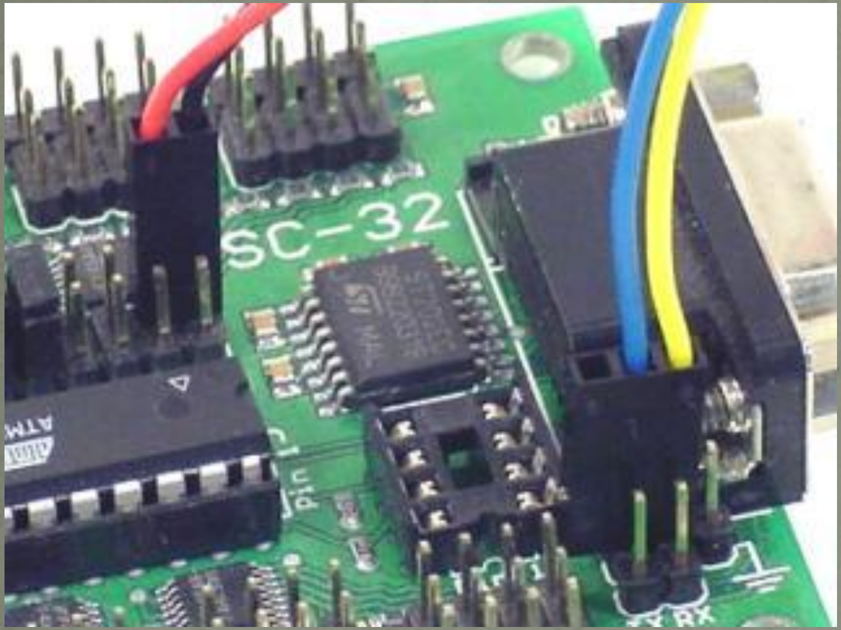
- Optimization
  - Microcontroller code optimization
  - Error handling
    - Restricted movement
    - Low battery
- Expansion
  - Vehicle options
    - Lights
    - Traction control
    - Speed reporting
  - Software add-ons

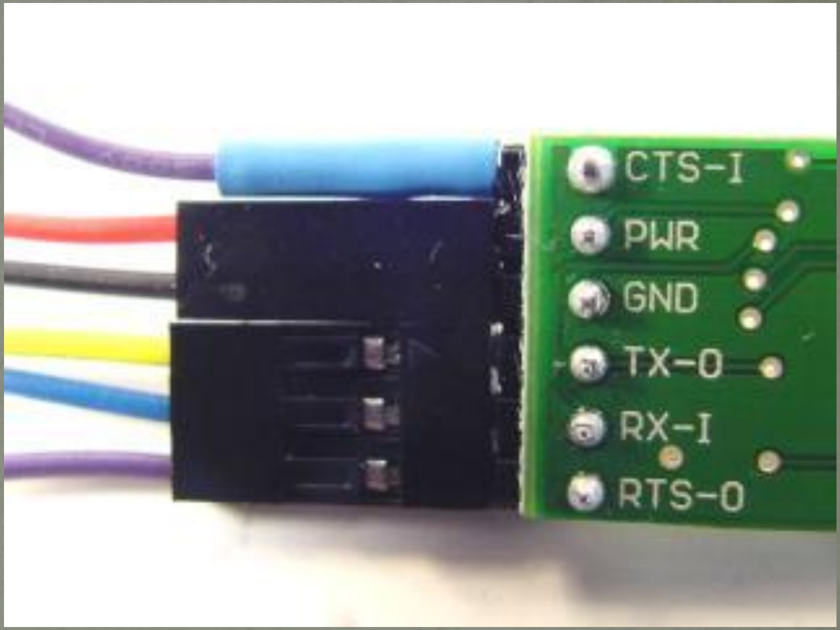
Conclusion

- The Verizon Droid Bluetooth stack is limited, by the kernel, on what it can connect to and how.
- The T-Mobile G1, with kernel modification, can successfully connect to the Bluetooth modem for controls.
- The vehicle has additional functionality, on top of the everyday control method.

Updates

- Hardware changes





Microcontroller connected

- Rx connection for receiving
- Tx connection for transmitting

Bluetooth modem connected

- Custom hardware soldered

Updates

- Code Snippets

```
void Change_Duty(char speed)
 {
        if (speed != motor_duty_)       // Check Same old speed
        {
               motor_duty_=speed;             // Save for old speed
               Pwm1_Change_Duty(speed);      // Motor A
               Pwm2_Change_Duty(speed);      // Motor B
        }
 }
void Motor_A_Forward()
{
        Pwm1_Start();
        PORTD.F0 =0;
        PORTD.F1 =1;
}
```

BluetoothService.java

Writing BYTE data to the Bluetooth mode,

```
PUBLIC VOID WRITE(BYTE[] OUT) {
        // CREATE TEMPORARY OBJECT
                CONNECTEDTHREAD R;
                // SYNCHRONIZE A COPY OF THE CONNECTEDTHREAD
                SYNCHRONIZED (THIS) {
                        IF (MSTATE != STATE_CONNECTED) RETURN;
                        R = MCONNECTEDTHREAD;
                }
                // PERFORM THE WRITE UNSYNCHRONIZED
                R.WRITE(OUT);
}


PUBLIC VOID WRITE(BYTE[] BUFFER) {
                TRY {
                        MMOUTSTREAM.WRITE(BUFFER);
                        // SHARE THE SENT MESSAGE BACK TO THE UI ACTIVITY
                        MHANDLER.OBTAINMESSAGE(BLUECAR.MESSAGE_WRITE, -1, -1, BUFFER)
                        .SENDTOTARGET();
                } CATCH (IOEXCEPTION E) {
                        LOG.E(TAG, "EXCEPTION DURING WRITE", E);
                }
}
```