



Prototype of an Animal Tracking System

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The topic of my diploma thesis is to create a prototype of an Animal Tracking System. The influencing factors in this project are seize, weight and the coverage area. The area of application for this tracking system are police dogs. The tracking unit is mounted on a dog's collar and the position of a dog is displayed in a control station. So police-officers are able to find their dogs while they are following up a suspect.

The main parts of the system are the Mobile Unit, the Tracking Station and the Transmission System.

The Mobile Unit consists of a CDPD (Cellular Digital Packet Data) modem, a GPS receiver and a power unit.

The tracking station is a PC with Internet connection and a Moving Map software program to display the position of the tracked subject.

I choose CDPD as Transmission possibility because this system has the best digital wireless features in New Brunswick and I also the best coverage of a digital network.

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Airlink Raven II CDPD modem

Garmin 35LP GPS Antenna - Receiver

9.6V rechargeable Battery supply

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Mobile Unit - System View





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AirLink CDPD Raven II



- is a rugged, full duplex Cellular Digital Packet Data (CDPD) modem
- provides wireless transport capabilities for fixed and mobile applications
- Features:
- 19.2 kbps raw data transfer rate
- Full duplex transceiver
- 600 mW transmit power
- Integrated TCP/IP protocol stack
- Physical Characteristics
- Weight: < 1 lb.
- Size: 3" width x 1" height x 5.1" length
- Operating Temperature Range -30° C to 70° C



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Garmin GPS35-HVS Receiver



Receiver:	Differential-ready 12 parallel channel receiver
Accuracy:	Position accuracy:
	Differential GPS (DGPS): 5 meters RMS
	Non-differential GPS: 15 meters RMS
Interfaces:	Dual-channel RS-232 compatible with user- selectable baud rate (1200, 2400, 4800, 9600)
	NMEA 0183
Antenna:	Built in
Size:	2.22" (w) x 3.79" (l) x 1.05" (h)
	(56.4mm x 96.3mm x 26.7mm)
Weight:	3.88 oz. (110 g), not including ca
Environmental:	Operating Temperature: -30°C to +80°C (internal temperature)
Input Voltage:	6 to 40 VDC, unregulated

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- RS232 to TCP/IP Converter TCP/IP to COM-Port Converter
- RS232 to UDP/IP Converter UDP/IP to RS232 Converter
- Wireless ACE CDPD-Modem Controlling Software
- Fugawi Tracker Software
- OziExplorer Moving Map Software

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Isometric View





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Front View





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Data Communication



Problems

Solutions

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Access the Internet







Access Gauss - Server





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Access PC - FTP Client/Server





Voyager Notebook - FTP Server

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Modem Control Software - Wireless ACE

ø	Vireless ACE - 198.2	29.77.111 [Ra	ven II]	_	
RS	SI: -76 BLER: 0%	Channel Cl 771	han Link	Reg	>>
	CDPD Modem PPP S	tatus			<u>?</u> ×
	General Details				
	Connection				- II
	Status:			Connected	
	Duration:			00:02:43	
	Speed:			19.2 Kbps	
	- Activity				-
		Sent —— 🗏	P	Received	
	Bytes:	9,965	1	5,333	
	Compression:	0%		0%	
	Errors:	0		0	
	Properties	Disconnect			
				Clos	e

Wireless ACE: Microsoft Windows based tool for configuring the AirLink modem and checking the modem's status

CDPD modems accept normally only AT commands through a terminal program. ACE translates this AT commands in a graphical Windows based interface.

Dial-up Network (DUN or PPP): this is the connection to talk to the modem locally over a serial port.

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Wireless ACE – Status Tab



Modem Status —				
Channel	771	Color Codes	0,1	
Side	B Side	Receive BLER	0	
RSSI (dBm)	-77	Transmit BLER	1	
BBM State	Acquired	SPI	266	
Link		WASI	266	
LINK	Established	SPNI	16408	
Network	Registered	Cell Number	101	
		Power Level	2	
		Power Product	48	
GPS Quality	N/A			
GPS Sats	N/A			

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Wireless ACE – CDPD Tab



Wireless ACE - 198.229.77.11	1 [Raven II]	
Modelin Conliguration		Current Template: None
Equipment ID	SW Revision	HW Model
00-60-D6-13-20-7C	ER200112BM Dec 13 2001 09:12:	46 NRM6832 rev 0C.05
CDPD Connection COM Po	nt Modbus Friends	
Parameter Name	Current Value	New Value
[\N] Side Preference	4:B side preferred	▼
[S110] Device IP Address	198.229.77.111	
[S110] Device Port	4	
[S116] Service ID Preference	3:Don't Care	<u> </u>
[S111] Service ID	0/0/0	
[S112] Channel List Mode	2:Hot Channel List	<u> </u>
[S113] Channel List	716,771,798,759,786,720,436,76	
[3W] 3 Watt Booster Support	0:No Booster Attached	
[*DSIDE] Disable Side Switch	0:Switch back to preferred side (d	v v
Status Write	to Modem Reset Modem	Copy All >> Clear New Refresh Modem Status
		Connected
][

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Wireless ACE – Connection Tab



🚽 Wireless ACE - 198.229.77.111 [Ray	ven II]		
File Tools Help			
Modem Configuration			
		Current Template: None	
Equipment ID	SW Revision	HW Model	
00-60-D6-13-20-7C EF	200112BM Dec 13 2001 09:12:46	NRM6832 rev 0C.05	
CDPD Connection COM Port Mo	dbus Friends		
Parameter Name	Current Value	New Value	
[S53] Destination IP Address	131.202.166.33		
[S53] Destination TCP/UDP Port	17334		
[553] Destination Connect Mode	Т		
[S210] AT Command Compatibility	1:Standard Modem Compatibility	•	
[S211] Ignore DTR	1:Ignore DTR	•	
[MD] Startup Mode Default	0:AT Startup Mode (normal)	•	
[MD] UDP Mode Default	0:Normal UDP	•	
[S60] Telnet Echo Mode	2:Remote Telnet Echo	▼	
[S82] UDP Half Open Mode	0:Disable UDP Half Open	▼	
Status Write to Mod	em Reset Modem	Copy All >> Clear New Re	fresh
		Modelli Status	
		Connected	
		[Local]	

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Wireless ACE – Communication Options



Communication Options	
C Destination	_ Status Timers
Local Host (PPP Using Windows DUN)	Status Update Interval (secs) 5
Remote Host (Wireless)	No Channel Status Update Interval (secs)
Address 198.229.77.111 Clear List	Stop Updating After 15 Mins Of Idle Time
Auto Dialup Connect (Windows DUN)	
Use Auto Dialup Connection:	Configuration Timers
C Never	Command Response Timeout (secs) 2
Only For Local (Direct PPP) Modems	Max Parameter Write Retries 3
C For Local and Remote Modems	Reset All the Timers to Default Values
OK	Cancel

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The Way it should be







Problem (1)





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□ NBTel, the CDPD service – provider changed the configuration in their network .

- □ NBTel opened a hole in their firewall to allow remotely controlling of the CDPD modem.
- Possibility to change the configurations in the modem remotely over the air with Wireless ACE.

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Different ways to receive GPS - Data



Image: Second system Image: Second system File Configuration Help {198,229,77,111} 44*78][\$GPGSV,3,2,11,11,06,176,00,13,28,235,43] {198,229,77,111} {198,229,77,111} 3,01,02,03,08,,13,15,17,22,27,31,,1,4,0,9,1,0*30][\$ {198,229,77,111} {198,229,77,111} 20,3,W*7F][\$GPRMB,A,...,V*71][\$GPGGA,135! {198,229,77,111} {198,229,77,111} GRMM,WGS 84*06][\$GPBOD,T,M,*47][\$GPRTE, {198,229,77,111} 1,76,196,54,...,*46][\$PGRME,3,7,M,4,2,M,5,6,M*2F] {198,229,77,111} I,76,196,54,...,*46][\$PGRME,3,7,M,4,2,M,5,6,M*2F] {198,229,77,111} I,86PGSV,3,2,11,11,06,176,00,13,28,235,44,15,13 {198,229,77,111} I,96PGSV,3,2,11,11,06,176,00,13,28,235,44,15,13 {198,229,77,111} I,9600,n,8,1 09:55:16, 02/26/2002

This software receives UDP-Data

These two software-packets receive TCP - Data

Connector: COM2 This PC Will Act As TCP Client This PC Will Act As TCP Client This PC Will Act As TCP Server This PC Will Act As TCP Server Coal IP Address Table Server Mode Port Local IP Address Table Server Mode Port Local IP Address Table Server Mode Buffer Size Buffer Size Buffer Size Buffer Size Buffer Size Transfer Info From Serial to TCP/IP Status Version Written By USTENING T.2.4 Carsten Gottbehuet, Germany Carsten Gottbehuet, Germany	erial Port:		C Connect to	or Hostname Port 7.111 23
Parity: None Coll IP Address C	Connector: COM2 Baud Rate: 9600	C This PC Will Act As TCP Client C This PC Will Act As TCP Server	Server Mode	Transfer Info
Flow Control: None Wait for timeout before transmit. I/O Options Timeout value (ms): 150	Parity: None Data Bits: 8 Stop Bits: 1	Local IP Address 131.202.166.31 Local Port 12345	Eusten on Port I2345 Buffer Size O Botes	Receive from TCP/IP Send to Serial From Serial to TCP/IP
	Flow Control: None Wait for timeout before transmit. Timeout value (ms): 150	1/0 Options	Status Version LISTENING 1.2.4	Written By Carsten Gottbehuet, Germany



NBTel CDPD Coverage New Brunswick







Canada Vector Street Map





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Ikonos Satellite Image – 4 m Resolution





Packet Transfer: **UDP**

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IKONOS 4-meter resolution Multi-spectral
IKONOS 1-meter resolution Panchromatic
Arial View
Caris Street Maps
Fugawi Vector Maps

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Configuration of the system with a second CDPD modem to make the Monitoring Station mobile

- **Real-Time Tracking Tests with adapted system**
- □ Housing of the unit mounting on a collar
- Real-Time tracking tests with the system mounted on a dog's collar

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