Predictive Automotive Safety

By Thabo Maqelepo

Hello I was wondering if you (or anyone) was by any chance be working on pre-emptive accident avoidance because to my knowledge, most modern automobiles have array of sensors and systems to avoid an impending collision with a vehicle or large animal, but in my view, this approach does not go far enough because it only addresses an obvious and “up-front” or “in-your-face” danger. But there are other equally dangerous situations which are often oblivious to motorist until its past the point-of-no-return, and the major factors that cause these accidents in my view are unknown or misjudged road obstacles, an over relaxed concentration level while behind the wheel and **SPEED**.

But an innovative system or feature could be added whereby all known road obstacles or rather hazards could be incorporated to an onboard geo database of which the system would constantly monitor for the one(s) which are being approached at an excessive speed and thus promptly warn the driver about the potentially hazardous situation ahead thus allowing the driver to take action without any hard braking or swerving, these on-road hazards may include potholes, humps or significantly uneven surfaces.

The system could go a step further by computing whether the vehicle would safely negotiate an upcoming curve by comparing the approach speed to the theoretical cornering speed plus a safety buffer. This cornering speed can be calculated because it is function of centrifugal forces around the corner’s centre versus the known maximum side friction limit of the vehicle, so if the approach speed is dangerously close to or at the cornering limit, the vehicle should again warn the driver while there is still a comfortable slowing-down margin to avoid an “Oooh F@&K” situation. Also such a safety innovation could help avoid dangerous incursion at T-junctions, Cross-Junctions, Rail crossing or even at road construction sites.

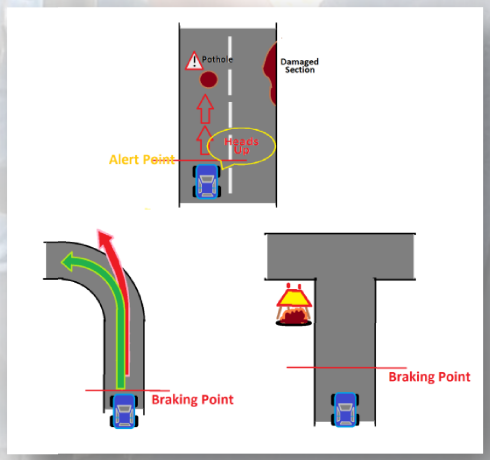


Figure 1. Obstacle Alerts.

This is not a farfetched safety concept because all the key technologies that can be used to successfully implement this innovation are already commonly available and are affordable, for example nearly all medium to high end vehicles have some form of satellite navigation and most have Smartphone style media centre that have decent processing power and some form of connectivity to the world. So for this to work it becomes a question of gathering the obstacle locations in a database, appropriately disseminating the information to the motoring public and letting the vehicle system do its thing.

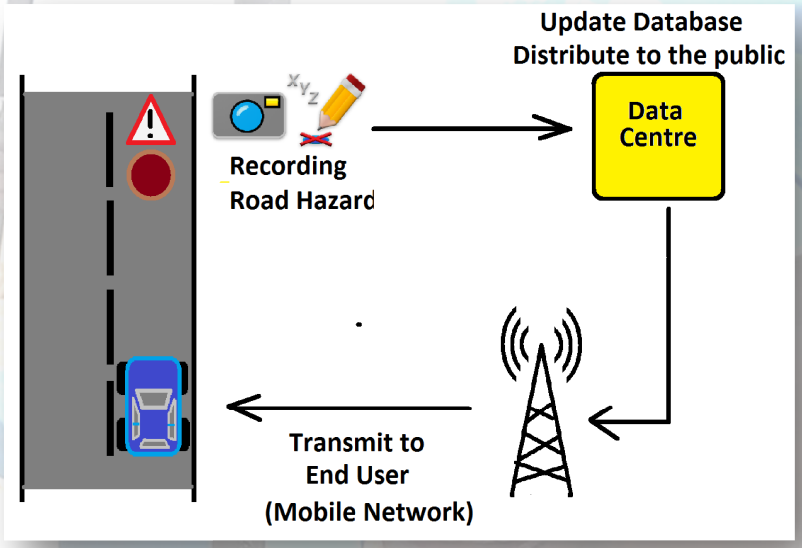
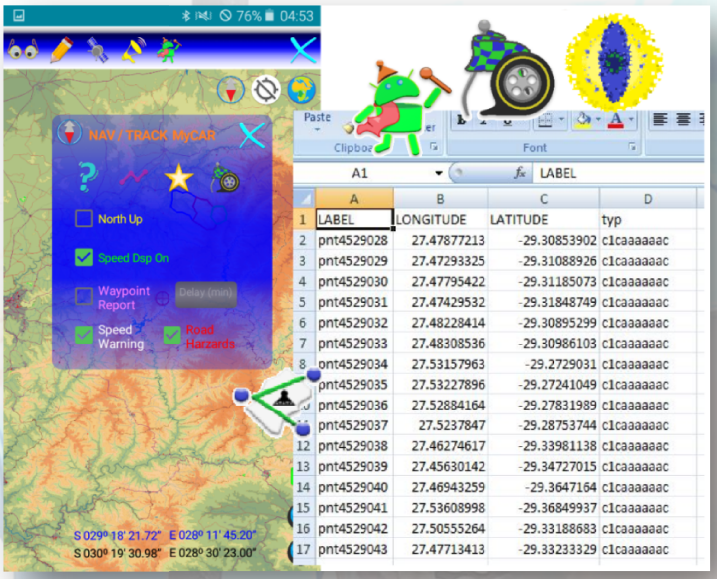


Figure 2. Data collection and dissemination

This safety feature meant to relieve motorist of their key responsibility which is driving in a safe manner nor will it eliminate road accidents, but an improvement of the safety aspect no matter how big or little will always have a positive feedback on the end-user and the industry in general and for an automotive manufacturer's standpoint this is a selling point that cannot be ignored.

I have been working on this issue on Android as part of a larger Geo-Mobile App that deals with mapping, navigation and tracking, basically a Geographic systems “Swiss Army Knife” and so far with the limited testing a have been able to conduct the results were promising and the following page show a screenshot of the mobile application (MyGIS.apk) in action alongside it is an extract of the road hazard database, below that is a sample image of the hazard points and following that is a code extract of the



	A	B	C	D
1	LABEL	LONGITUDE	LATITUDE	typ
2	pnt4529028	27.47877213	-29.30853902	c1caaaaaac
3	pnt4529029	27.47293325	-29.31088926	c1caaaaaac
4	pnt4529030	27.47795422	-29.31185073	c1caaaaaac
5	pnt4529031	27.47429532	-29.31848749	c1caaaaaac
6	pnt4529032	27.48228414	-29.30895299	c1caaaaaac
7	pnt4529033	27.48308536	-29.30986103	c1caaaaaac
8	pnt4529034	27.53157963	-29.2729031	c1caaaaaac
9	pnt4529035	27.53227896	-29.27241049	c1caaaaaac
10	pnt4529036	27.52884164	-29.27831989	c1caaaaaac
11	pnt4529037	27.5237847	-29.28753744	c1caaaaaac
12	pnt4529038	27.46274617	-29.33981138	c1caaaaaac
13	pnt4529039	27.45630142	-29.34727015	c1caaaaaac
14	pnt4529040	27.46943259	-29.3647164	c1caaaaaac
15	pnt4529041	27.53608998	-29.36849937	c1caaaaaac
16	pnt4529042	27.50555264	-29.33188683	c1caaaaaac
17	pnt4529043	27.47713413	-29.33233329	c1caaaaaac

Figure 3. MyGIS.apk Drive Mode Options

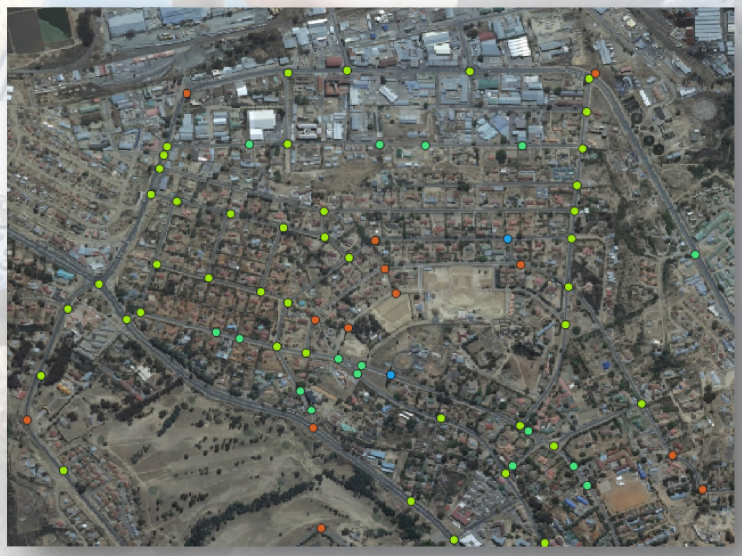
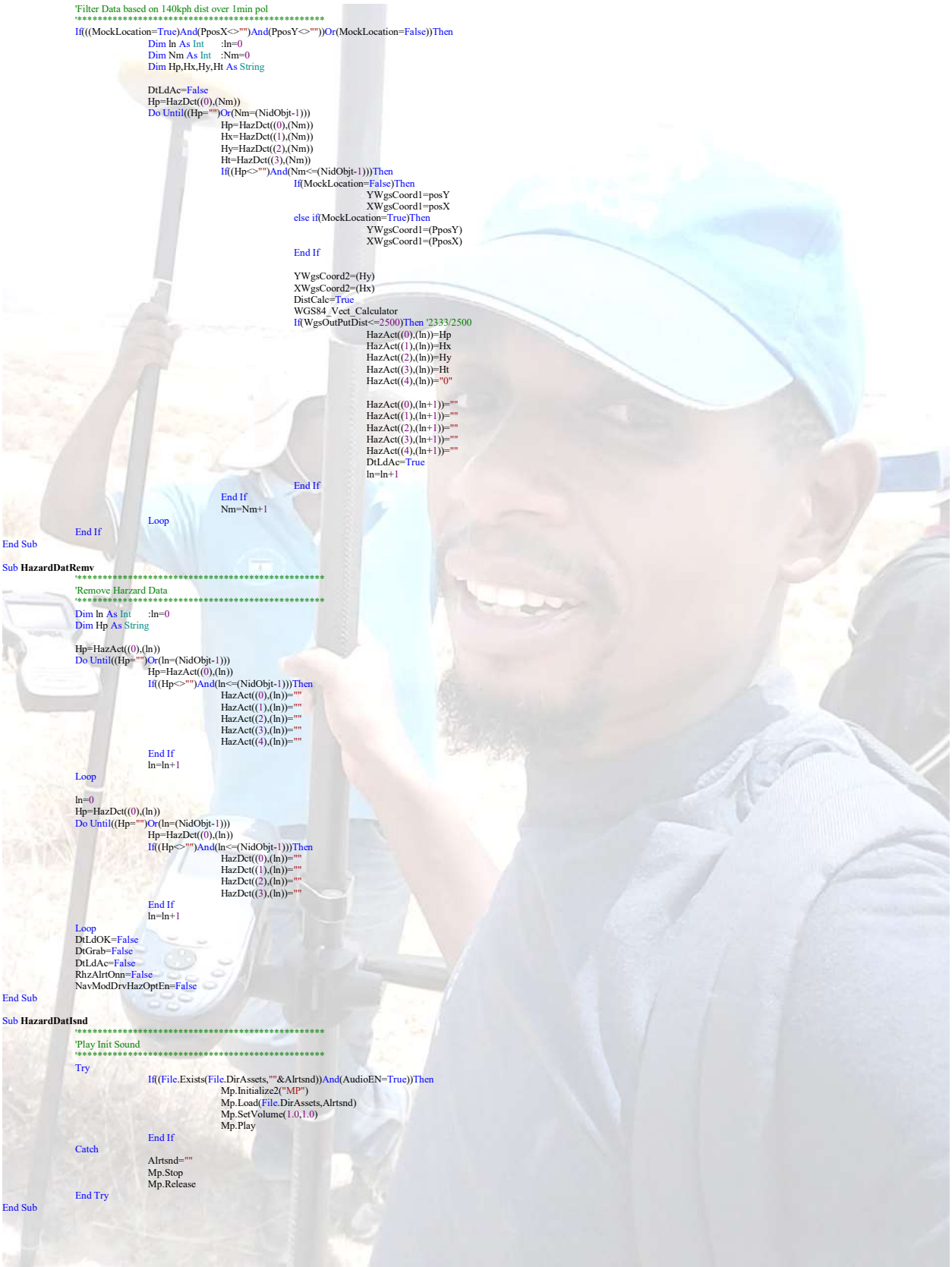


Figure 3. Road Hazard Points

MyGIS.apk Drive Hazard Modules (B4Android)

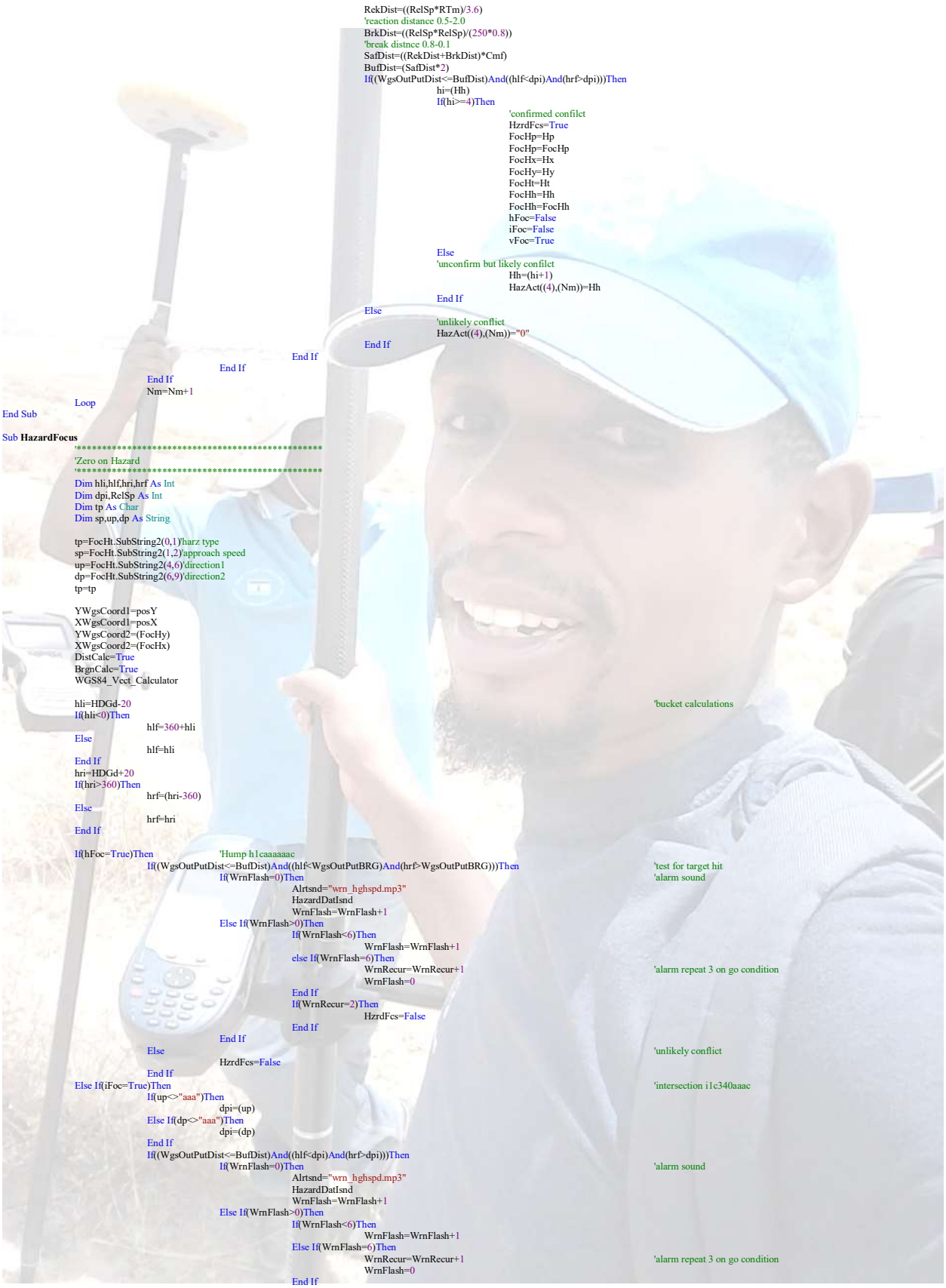
```
Sub OtherDrvHazTgglCfg
	'************************************************
	'toggle road harz
	'************************************************
	If(NavModDrvHazOptEn=False)Then		'set onn
		If(DtLdOK=False)Then
			GetRhzAlrt=True
			DrvHazDatSetup
			If(DtLdOK=True)Then		'initialize
				SetRhzAlrt=True
				RhzAlrtOnn=True		'set onn
				DrvHazDatSetup
				If(HrzAlrtCfgDisbl=False)Then
					SetDrvHrzAlrt=True
					HrzAlrOptEn=True	'create file
					DrvHrzSetup
				End If
			End If
		Else If(DtLdOK=True)Then
			SetRhzAlrt=True
			RhzAlrtOnn=True		'set onn
			DrvHazDatSetup
			If(HrzAlrtCfgDisbl=False)Then
				SetDrvHrzAlrt=True
				HrzAlrOptEn=True	'create file
				DrvHrzSetup
			End If
		End If
	else If(NavModDrvHazOptEn=True)Then 'set off
		SetRhzAlrt=True
		RhzAlrtOnn=False		'set off
		DrvHazDatSetup
		If(HrzAlrtCfgDisbl=False)Then
			SetDrvHrzAlrt=True
			HrzAlrOptEn=False	'remove file
			DrvHrzSetup
		End If
	End If
End Sub

Sub MyGISDrvHazCfg
	'************************************************
	'Safe Drive Config check
	'************************************************
	GetDrvHrzAlrt=True
	DrvHrzSetup			'Check for Enable file
	If(HrzAlrOptEn=True)Then
		GetRhzAlrt=True
		DrvHazDatSetup		'loa
		If(NavModDrvHazOptEn=False)Then		'activate save drive if enable file and good dictionary
			HrzAlrtCfgDisbl=True
			RhzAlrtSnd=True		'block first alarm
			OtherDrvHazTgglCf
			HrzAlrtCfgDisbl=False
		End If
	End If
End Sub

Sub DrvHazDatSetup
	'************************************************
	'check road harz dict and op settings
	'************************************************
	If(GetRhzAlrt=True)Then
		GetRhzAlrt=False
		If(DtLdOK=False)Then		'check load dictionary
			DrvHazDatLod
		End If
		If(DtLdOK=True)Then
			If(RhzAlrtOnn=True)Then		'check settings
				NavModDrvHazOptEn=True
			else If(RhzAlrtOnn=False)Then
				NavModDrvHazOptEn=False
			End If
		Else
			HazardDatRemv
		End If
	End If

	If(DtLdOK=True)Then
		If(SetRhzAlrt=True)Then		'Activa/deactivate hazard scan
			SetRhzAlrt=False
			If(RhzAlrtOnn=True)Then
				NavModDrvHazOptEn=True
			else If(RhzAlrtOnn=False)Then
				NavModDrvHazOptEn=False
				HazardDatRemv
			End If
		End If
	Else
		If(SetRhzAlrt=True)Then		'Activa/deactivate hazard scan
			SetRhzAlrt=False
			HazardDatRemv
		End If
	End If
	If(chkNavDrvHz.IsInitialized)Then
		If(NavModDrvHazOptEn=True)Then
			chkNavDrvHz.Checked=True
			If(RhzAlrtSnd=False)Then		'First alarm tone (only)
				RhzAlrtSnd=True
				Alrtsnd="wrn_hghspd.mp3"
				HazardDatIsnd
			End If
		Else If(NavModDrvHazOptEn=False)Then
			chkNavDrvHz.Checked=False
		End If
	End If
End Sub
```

```
Sub DrvHazGpsScan
        '*****************************************************
        'GPS is Active and Vectoing resolve Modules
        '*****************************************************
        HazBizi=True
        If(DtLdOK=False)Then
                DrvHazDatLod
        Else If(DtLdOK=True)Then
                If(HzrdFcs=False)Then
                        HazardDatClc
                Else If(HzrdFcs=True)Then
                        HazardFocus
                End If
        End If
        HazBizi=False
End Sub

Sub DrvHazDatLod
        '*****************************************************
        'Load Hazar data
        '*****************************************************
        Try
                DtGrab=False
                DtLdAc=False
                HazardDatGrab                           'extract File Data
                If(DtGrab=True)Then                     '2333
                        HazardDatFilt                   'Filter in New Data
                End If
                If(DtLdAc=True)Then                     'good load anf filter
                        DtLdOK=True
                End If
        Catch
                HazardDatRemv
        End Try
End Sub

Sub HazardDatGrab
        '*****************************************************
        'extract File Data
        '*****************************************************
        Try
                Dim FilObj0 As String                                   :FilObj0="MyGis"
                Dim FilObj1 As String                                   :FilObj1="VectorData"
                Dim FilObj2 As String                                   :FilObj2="Hazard00001"
                Dim Utf8Line As String
                Dim lineLen,StrLen,pnts As Int
                Dim lnNum As Int                                        :lnNum=0
                Dim CharExtr As Char
                Dim Num1Cap,Num2Cap,Num3Cap As Int

                Utf8Read.Initialize(File.OpenInput(sdf,FilObj0&"/"&FilObj1&"/"&FilObj2&".csv"))
                Utf8Line=Utf8Read.ReadLine
                Do While((Utf8Line<>Null)And(lnNum<=(NidObjt-1)))
                        Utf8Line=Utf8Read.ReadLine
                        If((Utf8Line<>Null)And(lnNum<=(NidObjt-1)))Then
                                lineLen=Utf8Line.Length
                                If(lineLen>7)Then
                                        StrLen=Utf8Line.Length
                                        CharExtr =""
                                        pnts=1
                                        Do Until(((CharExtr=",")Or(CharExtr=";"))Or(pnts=(StrLen-1)))'
                                                CharExtr=Utf8Line.SubString2(pnts,(pnts+1))
                                                pnts=pnts+1
                                        Loop
                                        Num1Cap=pnts '
                                        Dim zrchk As String
                                        zrchk=Utf8Line.SubString2(0,(Num1Cap-1))
                                        If(zrchk<>"0")And(zrchk<>"")Then '
                                                HazDct((0),(lnNum))=Utf8Line.SubString2(0,(Num1Cap-1))          'H p
                                                CharExtr =""
                                                Do Until(((CharExtr=",")Or(CharExtr=";"))Or(pnts=(StrLen-1)))'
                                                        CharExtr=Utf8Line.SubString2(pnts,(pnts+1))
                                                        pnts=pnts+1
                                                Loop
                                                Num2Cap=pnts '
                                                HazDct((1),(lnNum))=Utf8Line.SubString2(Num1Cap,(Num2Cap-1))  'H x
                                                CharExtr =""
                                                Do Until(((CharExtr=",")Or(CharExtr=";"))Or(pnts=(StrLen-1)))'
                                                        CharExtr=Utf8Line.SubString2(pnts,(pnts+1))
                                                        pnts=pnts+1
                                                Loop
                                                Num3Cap=pnts '
                                                HazDct((2),(lnNum))=Utf8Line.SubString2(Num2Cap,(Num3Cap-1))  'H Y
                                                CharExtr =""
                                                Do Until (((CharExtr=",")Or(CharExtr=";"))Or(pnts=(StrLen-1)))'
                                                        CharExtr=Utf8Line.SubString2(pnts,(pnts+1))
                                                        pnts=pnts+1
                                                Loop
                                                HazDct((3),(lnNum))=Utf8Line.SubString2(Num3Cap,StrLen)                 'H Type
                                                CharExtr =""
                                                '---------------------------------
                                                HazDct((0),(lnNum+1))=""
                                                HazDct((1),(lnNum+1))=""
                                                HazDct((2),(lnNum+1))=""
                                                HazDct((3),(lnNum+1))=""
                                                DtGrab=True
                                                lnNum=lnNum+1
                                        End If
                                End If
                        End If
                Loop
                Utf8Read.Close
        Catch
                DtGrab=False
        End Try
End Sub
```



```
Sub HazardDatFilt
	'*****************************************************
	'Filter Data based on 140kph dist over 1min pol
	'*****************************************************
	If(((MockLocation=True)And(PposX<>"")And(PposY<>""))Or(MockLocation=False))Then
		Dim ln As Int	:ln=0
		Dim Nm As Int	:Nm=0
		Dim Hp,Hx,Hy,Ht As String

		DtLdAc=False
		Hp=HazDct((0),(Nm))
		Do Until((Hp="")Or(Nm=(NidObjt-1)))
			Hp=HazDct((0),(Nm))
			Hx=HazDct((1),(Nm))
			Hy=HazDct((2),(Nm))
			Ht=HazDct((3),(Nm))
			If((Hp<>"")And(Nm<=(NidObjt-1)))Then
				If(MockLocation=False)Then
					YWgsCoord1=posY
					XWgsCoord1=posX
				else if(MockLocation=True)Then
					YWgsCoord1=(PposY)
					XWgsCoord1=(PposX)
				End If

				YWgsCoord2=(Hy)
				XWgsCoord2=(Hx)
				DistCalc=True
				WGS84_Vect_Calculator
				If(WgsOutPutDist<=2500)Then '2333/2500
					HazAct((0),(ln))=Hp
					HazAct((1),(ln))=Hx
					HazAct((2),(ln))=Hy
					HazAct((3),(ln))=Ht
					HazAct((4),(ln))="0"

					HazAct((0),(ln+1))=""
					HazAct((1),(ln+1))=""
					HazAct((2),(ln+1))=""
					HazAct((3),(ln+1))=""
					HazAct((4),(ln+1))=""
					DtLdAc=True
					ln=ln+1
				End If
			End If
			Nm=Nm+1
		Loop
	End If
End Sub

Sub HazardDatRemv
	'*****************************************************
	'Remove Harzard Data
	'*****************************************************
	Dim ln As Int	:ln=0
	Dim Hp As String

	Hp=HazAct((0),(ln))
	Do Until((Hp="")Or(ln=(NidObjt-1)))
		Hp=HazAct((0),(ln))
		If((Hp<>"")And(ln<=(NidObjt-1)))Then
			HazAct((0),(ln))=""
			HazAct((1),(ln))=""
			HazAct((2),(ln))=""
			HazAct((3),(ln))=""
			HazAct((4),(ln))=""
		End If
		ln=ln+1
	Loop

	ln=0
	Hp=HazDct((0),(ln))
	Do Until((Hp="")Or(ln=(NidObjt-1)))
		Hp=HazDct((0),(ln))
		If((Hp<>"")And(ln<=(NidObjt-1)))Then
			HazDct((0),(ln))=""
			HazDct((1),(ln))=""
			HazDct((2),(ln))=""
			HazDct((3),(ln))=""
		End If
		ln=ln+1
	Loop
	DtLdOK=False
	DtGrab=False
	DtLdAc=False
	RhzAlrtOnn=False
	NavModDrvHazOptEn=False
End Sub

Sub HazardDatIsnd
	'*****************************************************
	'Play Init Sound
	'*****************************************************
	Try
		If((File.Exists(File.DirAssets,""&Alrtsnd))And(AudioEN=True))Then
			Mp.Initialize2("MP")
			Mp.Load(File.DirAssets,Alrtsnd)
			Mp.SetVolume(1.0,1.0)
			Mp.Play
		End If
	Catch
		Alrtsnd=""
		Mp.Stop
		Mp.Release
	End Try
End Sub
```

```
Sub HazardDatClc
        '*****************************************************
        'TWS of Harzard
        '*****************************************************
        Dim Nm As Int    :Nm=0
        Dim Hp,Hx,Hy,Ht,Hh As String
        Dim hli,hlf,hri,hrf,hi As Int
        Dim dpi,RelSp As Int
        Dim tp As Char
        Dim sp,up,dp As String

        Hp=HazAct((0),(Nm))
        Do Until((Hp="")Or(HzrdFcs=True))
                Hp=HazAct((0),(Nm))
                Ht=HazAct((3),(Nm))
                If((Hp<>"")And(Ht<>"")And(HzrdFcs=False))Then
                        Hp=HazAct((0),(Nm))
                        Hx=HazAct((1),(Nm))
                        Hy=HazAct((2),(Nm))
                        Ht=HazAct((3),(Nm))
                        Hh=HazAct((4),(Nm))
                        tp=Ht.SubString2(0,1)'harz type
                        sp=Ht.SubString2(1,2)'approach speed
                        up=Ht.SubString2(4,6)'direction1
                        dp=Ht.SubString2(6,9)'direction2

                        YWgsCoord1=posY
                        XWgsCoord1=posX
                        YWgsCoord2=(Hy)
                        XWgsCoord2=(Hx)
                        DistCalc=True
                        BrgnCalc=True
                        WGS84_Vect_Calculator
                        hli=HDGd-20                                             'bucket calculations
                        If(hli<0)Then
                                hlf=360+hli
                        Else
                                hlf=hli
                        End If
                        hri=HDGd+20
                        If(hri>360)Then
                                hrf=(hri-360)
                        Else
                                hrf=hri
                        End If

                        If(tp="h")Then   'Hump h1caaaaaac
                                If((WgsOutPutDist<=BufDist)And((hlf<WgsOutPutBRG)And(hrf>WgsOutPutBRG)))Then                    'test for target hit
                                        hi=(Hh)
                                        If(hi>=4)Then                                                   'confirmed confilct
                                                HzrdFcs=True
                                                FocHp=Hp
                                                FocHp=FocHp
                                                FocHx=Hx
                                                FocHy=Hy
                                                FocHt=Ht
                                                FocHh=Hh
                                                FocHh=FocHh
                                                hFoc=True
                                                iFoc=False
                                                vFoc=False
                                                WrnFlash=0
                                                WrnRecur=0
                                        Else                                                            'unconfirm but likely confilct
                                                Hh=(hi+1)
                                                HazAct((4),(Nm))=Hh
                                        End If
                                Else                                                                    'unlikely conflict
                                        HazAct((4),(Nm))="0"
                                End If
                        Else If(tp="i")Then                                                             'intersection i1c340aaac
                                If(up<>"aaa")Then
                                        dpi=(up)
                                Else If(dp<>"aaa")Then
                                        dpi=(dp)
                                End If
                                If((WgsOutPutDist<=BufDist)And((hlf<dpi)And(hrf>dpi)))Then
                                        hi=(Hh)
                                        If(hi>=4)Then                                                   'confirmed confilct
                                                HzrdFcs=True
                                                FocHp=Hp
                                                FocHp=FocHp
                                                FocHx=Hx
                                                FocHy=Hy
                                                FocHt=Ht
                                                FocHh=Hh
                                                FocHh=FocHh
                                                hFoc=False
                                                iFoc=True
                                                vFoc=False
                                        Else                                                            'unconfirm but likely confilct
                                                Hh=(hi+1)
                                                HazAct((4),(Nm))=Hh
                                        End If
                                Else                                                                    'unlikely conflict
                                        HazAct((4),(Nm))="0"
                                End If
                        Else If((tp="c")And(tp="s"))Then   'Speed Conflict  s2caaaaaac / c5caaaaaac
                                RelSp=0
                                If(sp=1)And(SKPS>20)Then
                                        RelSp=SKPS-20
                                Else If(sp=2)And(SKPS>40)Then
                                        RelSp=SKPS-20
                                Else If(sp=3)And(SKPS>60)Then
                                        RelSp=SKPS-20
                                Else If(sp=4)And(SKPS>80)Then
                                        RelSp=SKPS-20
                                Else If(sp=5)And(SKPS>100)Then
                                        RelSp=SKPS-100
                                End If
                                If(RelSp>0)Then
```



```
                                                RekDist=((RelSp*RTm)/3.6)
                                                'reaction distance 0.5-2.0
                                                BrkDist=((RelSp*RelSp)/(250*0.8))
                                                'break distnce 0.8-0.1
                                                SafDist=((RekDist+BrkDist)*Cmf)
                                                BufDist=(SafDist*2)
                                                If((WgsOutPutDist<=BufDist)And((hlf<dpi)And(hrf>dpi)))Then
                                                                hi=(Hh)
                                                                If(hi>=4)Then
                                                                                'confirmed conflict
                                                                                HzrdFcs=True
                                                                                FocHp=Hp
                                                                                FocHp=FocHp
                                                                                FocHx=Hx
                                                                                FocHy=Hy
                                                                                FocHt=Ht
                                                                                FocHh=Hh
                                                                                FocHh=FocHh
                                                                                hFoc=False
                                                                                iFoc=False
                                                                                vFoc=True
                                                                Else
                                                                'unconfirm but likely conflict
                                                                                Hh=(hi+1)
                                                                                HazAct((4),(Nm))=Hh
                                                                End If
                                                Else
                                                                'unlikely conflict
                                                                HazAct((4),(Nm))="0"
                                                End If
                                        End If
                                End If
                        End If
                        Nm=Nm+1
                Loop
End Sub

Sub HazardFocus
                '*************************************************
                'Zero on Hazard
                '*************************************************
                Dim hli,hlf,hri,hrf As Int
                Dim dpi,RelSp As Int
                Dim tp As Char
                Dim sp,up,dp As String

                tp=FocHt.SubString2(0,1)'harz type
                sp=FocHt.SubString2(1,2)'approach speed
                up=FocHt.SubString2(4,6)'direction1
                dp=FocHt.SubString2(6,9)'direction2
                tp=tp

                YWgsCoord1=posY
                XWgsCoord1=posX
                YWgsCoord2=(FocHy)
                XWgsCoord2=(FocHx)
                DistCalc=True
                BrgnCalc=True
                WGS84_Vect_Calculator

                hli=HDGd-20                                                                                     'bucket calculations
                If(hli<0)Then
                                hlf=360+hli
                Else
                                hlf=hli
                End If
                hri=HDGd+20
                If(hri>360)Then
                                hrf=(hri-360)
                Else
                                hrf=hri
                End If

                If(hFoc=True)Then               'Hump h1caaaaac
                                If((WgsOutPutDist<=BufDist)And((hlf<WgsOutPutBRG)And(hrf>WgsOutPutBRG)))Then    'test for target hit
                                                If(WrnFlash=0)Then                                              'alarm sound
                                                                Alrtsnd="wrn_highspd.mp3"
                                                                HazardDatIsnd
                                                                WrnFlash=WrnFlash+1
                                                Else If(WrnFlash>0)Then
                                                                If(WrnFlash<6)Then
                                                                                WrnFlash=WrnFlash+1
                                                                else If(WrnFlash=6)Then
                                                                                WrnRecur=WrnRecur+1             'alarm repeat 3 on go condition
                                                                                WrnFlash=0
                                                                End If
                                                                If(WrnRecur=2)Then
                                                                                HzrdFcs=False
                                                                End If
                                                End If
                                Else
                                                HzrdFcs=False                                                   'unlikely conflict
                                End If
                Else If(iFoc=True)Then                                                                          'intersection i1c340aaac
                                If(up<>"aaa")Then
                                                dpi=(up)
                                Else If(dp<>"aaa")Then
                                                dpi=(dp)
                                End If
                                If((WgsOutPutDist<=BufDist)And((hlf<dpi)And(hrf>dpi)))Then
                                                If(WrnFlash=0)Then                                              'alarm sound
                                                                Alrtsnd="wrn_highspd.mp3"
                                                                HazardDatIsnd
                                                                WrnFlash=WrnFlash+1
                                                Else If(WrnFlash>0)Then
                                                                If(WrnFlash<6)Then
                                                                                WrnFlash=WrnFlash+1
                                                                Else If(WrnFlash=6)Then
                                                                                WrnRecur=WrnRecur+1             'alarm repeat 3 on go condition
                                                                                WrnFlash=0
                                                                End If
                                                                If(WrnRecur=2)Then
```

```
                                                                HzrdFcs=False
                                                        End If
                                        End If
                                Else                                                                    'unlikely conflict
                                        HzrdFcs=False
                                End If
        Else If(vFoc=True)Then                                                                          'Speed Conflict  s2caaaaaac / c5caaaaaac
                                RelSp=0
                                If(sp=1)And(SKPS>20)Then
                                        RelSp=SKPS-20
                                Else If(sp=2)And(SKPS>40)Then
                                        RelSp=SKPS-20
                                Else If(sp=3)And(SKPS>60)Then
                                        RelSp=SKPS-20
                                Else If(sp=4)And(SKPS>80)Then
                                        RelSp=SKPS-20
                                Else If(sp=5)And(SKPS>100)Then
                                        RelSp=SKPS-100
                                End If
                                If(RelSp>0)Then
                                        RekDist=((RelSp*RTm)/3.6)
        'reaction distance 0.5-2.0
                                        BrkDist=((RelSp*RelSp)/(250*0.8))                                                       'break distnce
0.8-0.1
                                        SafDist=((RekDist+BrkDist)*Cmf)
                                        BufDist=(SafDist*2)
                                        If((WgsOutPutDist<=BufDist)And((hIf<dpi)And(hrf>dpi)))Then
                                                If(WrnFlash=0)Then                                                              'alarm sound
                                                        AIrtsnd="wrn_hghspd.mp3"
                                                        HazardDatIsnd
                                                        WrnFlash=WrnFlash+1
                                                Else If(WrnFlash>0)Then
                                                        If(WrnFlash<6)Then
                                                                WrnFlash=WrnFlash+1
                                                        Else If(WrnFlash=6)Then
                                                                WrnRecur=WrnRecur+1
                                'alarm repeat 3 on go condition
                                                                WrnFlash=0
                                                        End If
                                                        If(WrnRecur=2)Then
                                                                HzrdFcs=False
                                                        End If
                                                End If
                                        Else
                                                'unlikely conflict
                                                HzrdFcs=False
                                        End If
                                End If
        End If
End Sub
```