VOICEOPERATEDOUTDOORNAVIGATION SYSTEMFORBLIND PERSONS

G.Perivina,M.Narmatha,M.Nandhini, G.Nandhinidevi
Final Year ,Department Of ECE,Kathir College of Engineering,Coimbatore.
Guided by Mrs.N.Vijayalakshmi ME.,
Assistant Professor,Department of ECE,Kathir College of Engineering,Coimbatore.
Guided by.Dr.M.Kannan ME.,Ph.D.,
Head of the Department,Department of ECE.Kathir College of Engineering,Coimbaore.

***Abstract*—The blind persons use several types to detect and avoidobstacles . Guide dogs,white canes is said to have limited aid for finding the way to a location. So the main objective is to create a portable, simple less costly system that will allow them to travel through unfamiliar environments without the aid of guides. Several guidance system has been developed for vision impaired people, but these are tends to be expensive also make the use of a client server approach. By the advancement in modern day ultrasonic sensor, pyroelectric sensor and ARM microcontroller technology, the proposed system aids in navigation via audible output, helping in localizing where they are and to improve their mobility. The audio output gives information on the navigation direction that makes use of GPS and alerts using various sensors. The aim of the project is to help the visually impaired to improve their communication and provides independency to them.**

Keywords:
ARM Processor, GPS, Blind, Voice assisted Navigation, Sensors.

I. INTRODUCTION

According to the recentsurvey,in worldwideIndiaisnowhaving 350 million people affected by visually impairedand 15 million of them are considered to be blind.About 87% of the visually impaired living in the developing countries [10]. Then over15 millionare fromIndia. [2]SoinIndiablindness isthebiggestproblem.The main causesofblindnessarecataract, uncorrected refractiveerrors,glaucoma, andmaculardegeneration.

Due to the huge populationthereisalotof traffic intheroadandeveryone in this worldhas no timeeventotalk witheachother especially inmetrocities. Sotheblindpeopleorvision impairedpersonfeelsalone inthisenvironment .It can be overcome by the advancement in the technology using sensing and recognizing it [3].Peoplewho haveimpairedvisionregularly usewhitecanesorguide dogs toassistinobstacleavoidance and have limited assistance.Guidedogscanalsobe of limitedassistanceforfinding thewaytoaremotelocation. This devices is simple but it has only limited range and not suitable for dynamic obstacle detection. Several electronicdevicesarecurrently availableforproviding guidance toaremotelocation,butthesetendtobeexpensive, ormakeuse ofaBrailleinterface.[4]. There is also Wearable navigationsystemforthe blind thatwillhelp in mappingandtrackingthe positionofthe pedestrian duringthetravel through theunknownenvironment.Travelling through an unfamiliar environment becomes a real challengeso ourgoalistocreateaportable, self-contained system thatwill help thevisuallyimpairedindividuals to travelthroughfamiliarandunfamiliar environmentswithouttheassistance of anyguides. The Navigation system, NAVIG device is used tocomplementconventionalmobilityaids and also foraddinguniquefeatures tolocalize specific objectsinthe environment,restore some motor abilities and assist navigation.[6].The paperdescribed heredevelopsaway that Navigation system, that makes useofGPS (the

Global Positioning System)[7],ultrasonic sensorforobstacledetection[8] and pyroelectric sensor[10]. ThecostofGPSunits is decreased, so it iscoupledwiththerecentgrowthintheavailability andpresentsanopportunity tocreatealowcostsolution.Amain function ofthissystemistoprovide theusersnavigational needs bylowcostandportability.[5]

The systemwill provide user the information about the currently located location and directions as the voice output.Thevisually impaired has the disadvantage, that they don't getneeded informationfor bypassing obstacles and hazards and have relativelylittle informationaboutlandmarks,headingthatisessential tosightedindividuals navigating throughfamiliarenvironments whohave goodknowledgeoftheseenvironments.The others navigate throughunfamiliarenvironmentson thebasisofexternalmaps andverbaldirections.TheGPSwayfinding systems areprimarily suitableforoutdoorenvironmentsbecausethereceive rsare is tunabletoperformgoodinanindoorenvironment.

The relativepositioningindoorsincludesensorsusing sonar,digitaltagsandaccelerometers for sensing the obstacles.Someofthem makeuse ofBraillekeyboard but is not as efficient as many of them don't know to use it.Toensurethatanavigation systemwillbe easily accessible bythe greatestproportionofvisionimpairedpeo ple.Thekeyfocusofthepaper,is to direct the people.The GPS is a portable navigation system which uses the NMEA protocol to get the location. The voice is to be heard by the user is displayed in the LCD display device [9]. The directions can be outputted as voice information fromthe system. The voice playback and recorder modulefunctions by recording the input data and it outputs the data through the play option through a headphone/ speaker.

Figure-1Blind People

II.WORKING AND BLOCK DIAGRAM

Theblockdiagram ofmainboardisshowninfig.2.Inthis diagramusingthe32-bitARMprocessor(TM4C123GH6PM),thisis theheartofthisproject.The (TM4C 123GH6PM) microcontrollersare basedona32-bitARM CORTEX M4FCPUwithreal-time emulationandembedded tracesupport,thatcombine microcontroller withembedded highspeedflashmemory ranging from256Kb.A 128-bit widememory interface and unique accelerator architectureenable32-bit codeexecutionatthemaximum clockrate. The power supply is given to the processor.

GPSreceiverisusedtogetthecurrent locationintheformoflongitudeandlatitude.GPSR eceiverwhichisa lowpower, ultra-highperformance, easy touseGPSreceiver.Itslowpowerconsumptionand high performance enables the adoption of AVL and other location based applications.It supports different electrical interfaces RS232 etc.GPS receiver supports NMEA0183 Protocol.TheoutputofGPSreceiverisgivento theprocessorusingUART interface and it is displayed in the LCD display.

Inthissystemvoice playback/voice recorderisusedtousetostorethe locationinformationandvoicedata. In this the voice can be recorded and then played when it is needed. It also contains erase, volume options in it. It is connected to processor by SPI (Serial Peripheral

Interface).Theotherimportant partsofthesystemarejoystick, ultrasonic sensor, magnetometer andpyroelectric sensor.Joystick isusedfordirection selection (i.e.north,south,east&west. Ultrasonic sensorisusedforobstacledetection which gives an alert when obstacle is detected. It is connected to a processor by Parallel port interface. Pyroelectric sensor is used to detect the presence of living being, on identifying it gives a voice input as living body.It is interfaced to a processor by ADC Interface. Inthis system outputisintheformofvoicesoweareusingaudio amplifier&speaker/headphone. Audioamplifierisusedto amplifythevoicesignalstoredinthevoice ICsothatit is properlyhearable.Thisamplifiedvoiceisthenheardb yusing speakerorheadphone. The LED is connected to indicate the working.

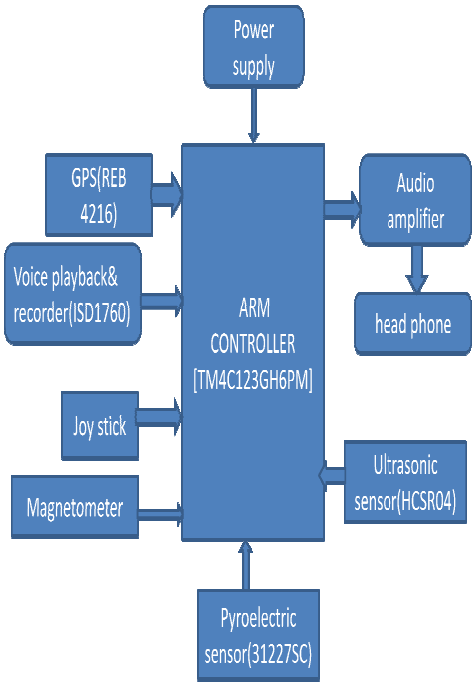

Figure-2Blockdiagram

III.HARDWARE DESCRIPTION

1.MICROCONTROLLER

The TM4C123GH6PM microcontroller package contains 64-pin LQFP combines complex integration and high performance with core which is ARM Cortex-M4F processor.Its performance is 80MHz operation and 100 DMIPS performance. It has a flash memory of 256KB single-cycle.It has system SRAM of 32KB single-cycle.It has EEPROM of 2KB.The communication interfaces in microcontroller are eight UART's,four SSI modules,four I2C ,two CAN2.0 A/B controllers,and USB 2.0 OTG/Host/Device.The system has Micro Direct Memory Access,General-purpose Timer,Watchdog Timer, and Hibernation module, General-Purpose Input / Output.The advanced motion controls are PWM,Quadrature Encoder Interface.It also has analog support of ADC,Analog Comparator Controller. Digital Comparator,JTAG and Serial Wire Debug.[11].

2. AUDIO AMPLIFIER

The LM386isapoweramplifier which is used inlow voltageconsumerapplications.Thegainisinternall ysetto20 tokeepexternalpart countlow,buttheadditionof an external resistorand capacitorbetweenpins1and8willincrease the gaintoanyvaluefrom 20to200.Theinputsareground referencedwhiletheoutputautomatically biasestoone-half the supply voltage. Thequiescentpower drain isonly24 milliwattswhenoperatingfroma6voltsupply,mak ing the LM386idealforbatteryoperation.

3.GPS MODULE

RoyalTek REB-4216 is the GPS module of SiRFstar IV. The module is powered by latest SiRF Star IV GSD4e ROM chip and RoyalTek proprietary navigation technology that provides you with stable and accurate navigation data. The smallest form factor and miniature design is the best choice to be embedded in a device such as portable navigation device, personal locator, speed camera detector and vehicle locator. The Product Features are given below. It have 48 track verification channelsand power supply 3.3V voltage. SMT type with stamp holes.Thesmall form factor with embedded SiRF Star IV technology. It alsoremoves in-band jammers upto 80 dB-Hz, track up to 8

CW jammers.It has an excellent sensitivity for urban canyon and foliage environments.

The technical specification of GPS Module is described below.It has an Impedance of 50Ω. It has anoperating/Storage temperatureof-40 ~ 85°c. The Humidity is less than or equal to 95%.

NAME	Example	Units	Description
MessageID	$GPGGA		GGAprotocolheader
UTCPosition	161229.48		hhmmss.sss
Latitude	3723.2475		ddmm.mmmm
N/SIndicator	N		N=northorS=south
Longitude	12158.341		Dddmm.mmmm
E/WIndicator	W		E=eastorW=west
PositionFixIndicator	1		
SatellitesUsed	07		Range0to12
HDOP	1.0		HorizontalDilutionof Precision
MSLAltitude	9.0	meters	
Units	M	meters	
GeoidSeparation		meters	
Units	M	meters	
AgeofDiff.Corr.		second	NullfieldswhenDGPSIsot Used
Diff.Ref.StationD	0000		

The Position accuracy is within 10m for 90% (24hr static, -130dBm). The protocol is of default 9600bps they are GGA(1),GSA(1),GSV(5),RMC(1).

The software Interface uses NMEA Protocol. The NMEA Output Messages: the Engine board outputs the following messages as shown below,

GGA -Global positioning system fixed data
GSA -GNSS DOP and active satellites
GSV -GNSS satellites in view
RMC -Recommended minimum specific GNSS data
GLL -Geographic position – latitude/longitude
VTG -Course over ground and ground speed

The GGA-Global Positioning System Fixed Data contains the fixed data format as shown below,

$GPGGA, 161229.487,3723.2475,N,12158.3416,W,1, 07,1.0,9.0,M,,,,0000*17

Checksum	*18		
< CR > < LF >			Endof messagetermination

GGA DATA FORMAT

The GSA-GNSS DOPandActiveSatellites containsthevaluesofthefollowingexample:

$GPGSA,A,3,07,02,26,27,09,04,15,,,,,,1.8,1.0,1.5*33

TheGLL-GeographicPosition–Latitude/Longitude containsthevaluesofthefollowingexample:

$GPGLL,2503.6319,N,12136.0099,E,053740.000,A,A*52

Name	Example	Unit	Description
MessageID	$GPGLL		GLLprotocolheader
Latitude	2503.6319		ddmm.mmmm
N/Sindicator	N		N=northorS=south
Longitude	12136.0099		Dddmm.mmmm
E/Windicator	E		E=eastorW=west
UTCTime	053740.000		hhmmss.sss
Status	A		A=datavalidor V=datanotvalid
Mode	A		A=autonomous, D=DGPS,E=DR
Checksum	*52		
<CR><LF>			Endof message termination

GLL DATA FORMAT

The GSV-GNSS SatellitesinViewcontainsthevaluesofthefollowingexample:

$GPGSV,2,1,07,07,79,048,42,02,51,062,43,26,36,256,42,27,27,138,42*71

$GPGSV,2,2,07,09,23,313,42,04,19,159,41,15,12,041,42*41

Name	Example	Unit	Description
MessageID	$GPGSV		GSVprotocolheader
TotalNumberof Messages	2		Range1to3
Mode1	A		Automatic allowed
Mode2	3		3D
Messages Number	1		Range1to3
IDofSatellite	07		SvonChannel1
SatellitesinView	07		
SatelliteID	07		Channel1(Range1to32)
IDofSatellite Used	02		SvonChannel2
Elevation	79	Degrees	Channel1(Range00to90)
Azimuth	048	Degrees	Channel1(True,Range000to359)
IDofSatellite Used			SvonChannel12
SNR(C/No)	42	dBHz	Channel1(Range0to99,nullwhen
SatelliteID	27		Channel4(Range01t
Elevation	27	Degre	Channel4(Range00t
Azimuth	138	Degre	Channel4(True,Ran
SNR(C/No)	42	dB-Hz	Channel4(Range00t nullwhen
Checksum	*71		
< CR >			Endof messagetermination
< LF >			

Name	Example	Unit	Description
< CR > < LF >			Endof messagetermination

GSV DATA FORMAT

The RMC-RecommendedMinimum SpecificGNSSdatacontainsthevaluesofthefollowingexample:

$GPRMC,161229.487,A,3723.2475,N,12158.3416, W,0.13,309.62,120598,,*10

Name	Example	Units	Description
MessageID	$GPRMC		RMCprotocolheader
UTCTime	161229.47		hhmmss.sss
Status	A		A=datavalidorV=datanotvalid
Latitude	3723.2475		ddmm.mmmm
N/SIndicator	N		N=northorS=south
Longitude	12158.3416		dddmm.mmmm
E/WIndicator	W		E=eastorW=west
SpeedOverGround	013	knots	True
CourseOverGround	309.62	degrees	
Date	120598		Ddmmyy
MagneticVariation		degrees	
Variation sense			E=eastorW=west(Notshown)
Mode	A		A=Autonomous,D=DGPS,E=DR
Checksum	*10		
<CR><LF>			Endof messageterminati

RMCDataFormat

The VTG-CourseOverGroundandGroundSpeedcontainsthevalue softhefollowingexample:

$GPVTG,79.65,T,,M,2.69,N,5.0,K,A*38

The data format of VTG is given below :

Name	Exaple	Unit	Description
MessageID	$GPVTG		VTGprotocolheader
Courseovergound	79.65	Degrees	Measuredheading
Reference	T		True
Courseoverground		Degrees	Measuredheading
Reference	M		Magnetic
Speedoverground	269	Knots	Measuredspeed
Units	N		Knots
Speedoverground	5	Km/hr	Measuredspeed
Units	K		Kilometerperhour
Mode	A		A-autonomous,D=DGPS,E
Checksum	*38		
<CR><LF>			Endof messagetermination

VTGDataFormat

4. HC-SR04 UltrasoundMotionSensor

TheHCSR04ultrasonic Motionsensorprovidesprecise,non-contactdistancemeasurementsfromabout2cm-400cm.Itisvery easy to connect to microcontrollersrequiringonlyoneI/Opin. TheHCSR04sensorworks bytransmitting anultrasonic(wellabovehumanhearing range) burstandprovidinganoutput pulsethatcorrespondsto thetime requiredfortheburstechotoreturntothesensor. This module encloses ultrasonic Transmitters, receiver and control circuits. By measuringtheecho

pulsewidth,thedistancetotargetcan easily be calculated

5.VOICE PLAYBACK AND RECORDER

This module is a single-chip single-message record/playback device. Recordings are stored intoon-chip non-volatile memory, providing zero-power message storage. Time for recording is 8-20 seconds. Its power input is DC 2.4-5.5v.With the internal audio amplifier, this board can drive 8ohm,0.5w speaker directly. Microphone is present on this module. All the spins are extended with a connector, which can be powered and controlled.

6.Pyroelectric Sensor

This module is an infrared sensitive optoelectronic component which are specifically used for detecting electromagnetic radiation in the wavelength range from 2-14 um. It consists of a single crystalline lithium Tantalite .It has extremely low temperature coefficient with a excellent long term stability of a single voltage.It has two slots in it each slot is made up of special material that is sensitive to IR

7.LCD(16x2)

LCD (Liquid Crystal Display) screen is an electronic display module and it is used in a wide range of applications. A 16x2 LCD display is very basic module and it is very commonly used in various devices and circuits for displaying. These modules are preferred over seven segments and other multi segment LEDs because they are economical; easily programmable; have no limitation of displaying special & even custom characters which is an drawback in seven segment. The command register stores the command instructions given.A instruction given to LCD is to do a predefined task like initializing it, clearing screen, setting the cursor position, controlling display etc. The data register stores the data to be displayed on the LCD. The data is the ASCII value of the character to be displayed on the LCD.

IV CONCLUSION

In this paper, the discussion is about that India is now having 1.22 billion blind people. So this project is to help the blind people with greatest possible accuracy and a low cost, user friendly system that which aid them without any guidance by others. In this project we use ARM processor which contains interfaces, memory and its operating speed is high. The GPS module is used for navigation which plays the main role for finding the current location. Also we use ultrasonic sensor, pyroelectric sensor for detection of obstacles and to identify the living body. The magnetometer is used to find the direction. The temperature is known using the internal temperature sensor present in the processor. In future it can be enhanced for providing end-to-end information on route from source and destination.

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