Automated System for Visually Challenged

[1]A.Sakthi [2]A.Kavitha [3]K.Peter
[1]Research Scholar, Anna University, [2]Research Scholar, Anna University,[3]Research Scholar, Karpagum University
{Email:sakthijesma@gmail.com, akavithaape@gmail.com, faffyroypeter@gmail.com}

Abstract: **This paper brings out the simple solution and basic need of visually challenged, by making the mmore independent. This implementationis carriedonusingGlobalPositioning System (GPS)andRadioFrequency Identification (RFID)technologies withinterpretation unittoacquireasolutioninacosteffective, portable, flexible,unobtrusive andinanefficientmanner, where interpretation reliesonthemethodofconvertingan arbitrary imagetoasoundthrough avirtual eyeand earplugs. SinceGPSsignals areabsentorgreatly attenuatedintheindoor,RFIDisimplemented witha network ofnavigational beacons. Thepaperworkswith someofthetechnical challenges andproposedsolutions fornavigationandinterpretation.**

Index Terms: RFID Tags, Interpretation & Navigation mode,GPS signal

I.INTRODUCTION

VisuallyChallengedpeopleare facingintimidating challengesin achievingindependentmobility. Theproposed modelworksin twomodesofoperation,(i)Interpretation modeand(ii)Navigationmode.In theInterpretationmode, userwillbeabletoreadusingavirtualeyewhich takes the pictureofthepagethatistobereadandconverts thetextto speechwiththehelpinterpretation unit, whichconsistof Virtualeye(camera)mountedon aspecswithearplugsand LED, this in turn is connected to a portable device comprising the embedded system which process the necessaryinformationand whichcanberetrievedfromthe memoryasdefinedbytheuser. IntheNavigationmode,this workswithGPSandRFIDmadeautomateddependingon the environment. Whilenavigatingopen-air,GPSgivesa senseoflocationatpresentandtheinformation isconveyed intheform ofaudiousingavoicedictionary. Ontheother hand indoor navigationiscarried using RFIDtagswith the networkofbeacons.The automationis donewithresponseto dominationofthecorrespondingRFIDorGPSsignal.

II.SYSTEMOVERVI EW

Tomakethemodelto bestusefortheuserthefollowing featuresare ledforperfectaid,

•**Size:**Thedeviceisportable anditisaslightaspossible becauseitisveryawkwardforablindpersontocarrya heavydeviceinadditiontomanaging aguidedogorwhite cane.

•**Voiceoutput:** Themodelhasavoiceoutputinwhichthe textandpositionare givenasthe feedback

•**Switches:** Themodelhassixswitchesinwhichtwoare mode selection (Interpretation/ controller) switches and otherareaccessswitches(play/pause, Forward, Backward, Mute)anda volumecontrol

•**UserFriendliness:**Thedeviceisvery easytouseandhas mostofthefeaturesfortheuserspreference

•**Levelofhearing:** Sinceblindpersonsalsocanhave hearing problems, the devicehas headphones and convenient volumecontrol..Toavoidinterferingwith importantenvironmental cuessonecessaryforindependent mobility,the device'sauditorymessagesare short rather thancontinuous.

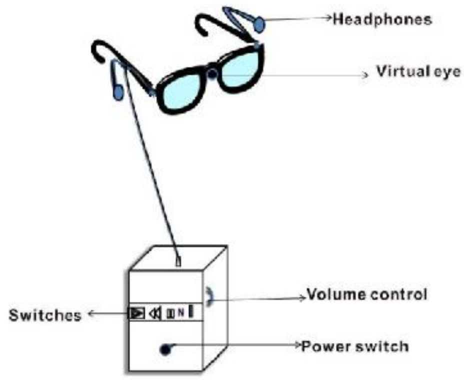

Fig.1.ProposedModel

III.SYSTEM MODEL

Asshowninthefigurethecameraisattachedto the glasses and highpowerLEDsarealsoattachedto enhancethe imagescapturedindimlight.Thisinturnisconnectedto a portableprocessorcomprisingofembeddedsystemsthat processesthenecessaryinformation.Theprocesseddatais convertedto sound, whichcanbe heardthroughthestereo Earplugs.Theprocessorconsistsof6 buttonsto activatethe following,whichareINTERPRETATIONmodeand NAVIGATIONmode,thesebuttonshaveprojections,for the visuallychallengedto distinguishthem.

IV.SYSTEMARCHITECTURE

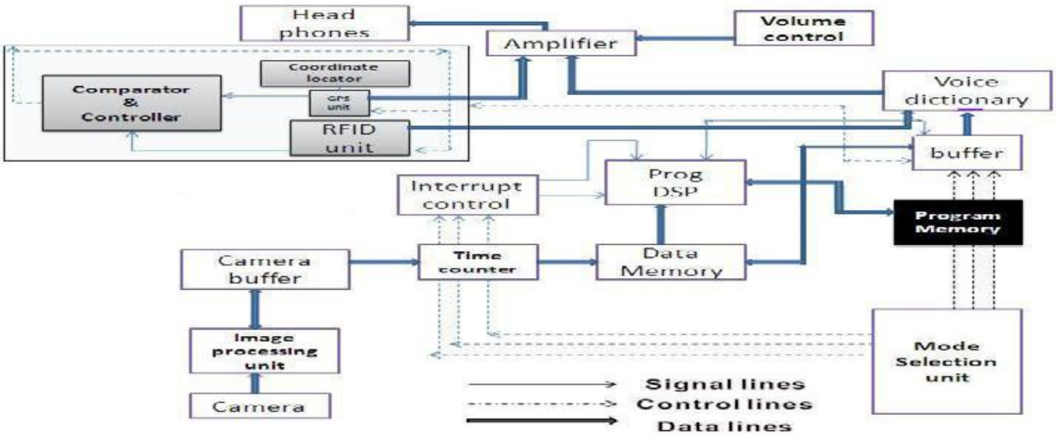

Fig.2.INASArchitecture

Inthereadmodetheimagestobeextracted isstoredinthe datamemoryandtheimages aretransferredtotheprocessor, whichin turn processesthedatawith thehelp of theroutines loadedintheprogrammemory.Thecamerahasprovisionsto protecttheC-MOSsensor.Thisisin turn connected tothe image-processing unit,whichisusedtocontroltheaperture openingandhistogram equalization,sothatthereflective surfaceerrors canbeavoided.Theimages arestoredinthe camerabufferandaresenttothedatamemory .Thetextis extractedandthecorresponding ASCIIvaluesarestoredin thedatamemory withthehelpofqueue.When theplay buttonispressed, thesignal issenttotheDSP,whichinturn extractsthedatafromthedatamemory andsendsittothe buffer. Thisbuffersends thedatatothevoice dictionary, which compares the ASCII values with the inbuilt vocabulary andplaysthenoteifthecodematches;elsethe wordisspeltout.Theinterrupt controller isusedtocontrol theworking oftheprocessorinread,navigationmode,or dormantmode (mute).IntheNavigation mode,GPSis activatedindefault andthevoicesignals generated are amplifiedandsent toHeadphones,WhentheGPS signalsare greatly attenuated the device will start transmitting RF signals(assumedtobeinindoor) bytheRFIDunitinthe system.Thepowersectionsupplies thepowerforthewhole circuit withthe helpofbatteries.

V.INDOORNAVIGATIONUSING RFID

As there are many indoor navigationalsystems which is independentofGeosynchronous satellitesignalssuchas Talking Signs™,aninfraredbasedspeechmoduleandall wallmountedenunciators aredifficulttoimplement because wallmountedenunciatorsrequirebuildingretrofit,theyare notcost-effectiveand have notbeen widelyuseddueto their inherentinflexibility and highimplementation costs.The RFIDtagsorbeaconswouldoffernavigation signalsina approach similarthosegeneratedbytheGeosynchronous satelliteswhichcirclingour planetandavailableatoutdoors. Radiofrequencyidentification tagsworkingintandemwith RFIDreaderscanservethepurposeinalowcostflexible andpersonalizedfashion.RFIDreaderintegrated intothe suitable hardware platform which could periodically transmitinterrogationsignalsin tothesurroundingstoprobe forany nearbyRFIDtags.Whenthesignalis receivedbyan antennaembedded intoasmallRFIDtag(beacon)thetag acknowledges bysendingbackaidentificationinformation. Thesignalreceivedbythetransceiver isamplified and interpretation isbroughtbythedetection andanalysis algorithm.Usingthatinformation avoicedatabaseguide travelertowardhis/herintendeddestination [1].Many commerciallyavailableRFIDbeaconsarelowcost,but their rangeofdetection byaRFIDreaderislimited–lessthan2 meters.Thedetection rangeoftagscanbeincreasedwith improvedRFIDtagsanddirectionalantennas.

VI.RFIDTAGS

RFIDtagisamicrochipconsisting ofatrans-receiver combinedwithanantennainacompactpackageOperating in2.40GHz,thetag'santennapicksupsignalsfroman RFIDreaderand thensends backa signaltotheRFIDreaderasanacknowledgement withuniquecustomized information. The tagoperating in 2.40GHzhasthefollowingspecifications:

- Tagsizesmallerthaninductiveor lowerrangeUHF(1"x1/4")
- Range:greaterrangethan inductivew/obattery
- Morebandwidththanlower rangeUHF(more frequenciesto hop)
- Smallerantennasthanlower rangeUHForinductive
- Highdatarate

1. The detectionrange canalsobeextended by addingpower totheRFIDtagssoan activeRFID tagis implemented.

2.Tominimizetheinconvenience oftheperiodicbattery replacement solarpoweredactiveRFIDtagsaretheonly solution.

3.TheRFIDtagsareincorporated withtheomnidirectional antennasuchasmicrostripantenna sothattheycould respondtointerrogationsignalsinany direction. Oneof the simplestmicrostripantennasisarectangular patch antenna resting onaregularmicrowave substrate. Itsdirectional radiation patternbasedresultsfrom thefullwaveanalysis indicatesthatsuch asimpleantenna canhaveagainof6dBi withverylowcross-polarizationlevel.Utilizingdirectional Antennasthat havea6dBi gain couldalone increase thedetectionrangeoftheRFIDtagbya factorof four.

VII.OUTDOORNAVIGATION USINGGPS

Thebestway toknowwhereyouareisby using theglobal positioningsatellite(GPS)constellation ofsatellites,a collectionofatleast24satellitesorbiting26,560kmabove theEarth.Ignoring blockagefrommountains, buildings,and such,threesatellites areguaranteed tobevisiblefrommost placesoftheEarth,enoughtoclosely approximate our latitude andlongitude.Fourormoresatellites areusually visible, enough to determine the position in three dimensions. SincetheUEREoftheGPSisabout6meters (approx.), theaccuracy candowellwiththeoutdoor navigation.

Inessence,theGPSoperates ontheprincipleof trilateration. In trilateration, thepositionofanunknownpointis determinedbymeasuringthelengthsofthe sidesofa trianglebetween theunknown pointandtwoormoreknown points(i.e.,thesatellites). Thisisopposedtothemore commonly understood triangulation,whereaposition is determined by taking angular bearings from two points a known distance apart and computingtheunknownpoint's positionfrom theresultanttriangle.Therefore, theonly thing needed bythe usertocalculatedistancefromany givensatelliteisameasurementofthetimeittookforaradio signaltotravelfromthesatellitetothereceiver. Bythis method,theGPSunitgetthelatitudeandlongitude location oftheusersposition. Thenthiscoordinates isgivento coordinate locater which has a inbuilt map in it the coordinatelocatersuperimposes thecoordinatesonthemap andfindthelocationwheretheuserisandreturns itbackto GPSunit.Sincethevoicesignals aregenerated intheGPS unitanddirectly fedintothevoiceamplifier. TheGPSunit willreadthelocation aloudsothatblindpeoplecanableto navigatetheirpath.

VIII.INTERPRETATION MODEALGORITHM

Inourapplication, ablinduserfirsttakesapicture,and then our systemautomatically detectstextareasinthepictureand deliversthelayoutof thedocument.Finally, textcanbe transformedintospeechsignalandtheirmajorconstraints aretheTextimagedeterioration andlowcomputational resources.Thefirstisdetectionandlocalization ofthetext regions. Theideaistolocatethetextelementswithout necessarily recognizingthem,cutthemoutoftheimage, determinethereading orderandfinally correcttheir perspective.The read mode uses the principlesof OCR, which deals with the recognitionof the printed text and storingitinthecodedstandards themostintuitive characteristics oftextareitsregularity.Printedtextconsists of characterswith approximatelythe samesizeandline thicknessthatarelocatedataregulardistancefrom each other.Suchregularitiescan alsobeobservedfromedges beingdetectedontextualboundaries Textshowsspatial cohesion—charactersof thesametextstring (a word, orwordsinthesameline)areofsimilarheights,orientation,and spacing.Characterscontrastwiththeirbackgroundsince theyaredesignedtobereadeasily.Characters appearin clustersatalimiteddistancealignedtoavirtualline.Most ofthetimetheorientationofthesevirtuallinesishorizontal sincethatistheconventionalwayofwriting.Most of the previousresearchesabouttextdetectionfocus onextractingtext fromvideo.Techniquesappliedtoimages orvideokey framescanbroadly beclassifiedasedge,color([5],[6])or texturebased([4],[10]). Eachapproachhasits advantages/drawbacks concerningaccuracy,efficiencyand computational requirements.Edgebasedtechniquesuse edgesinformationinordertocharacterize textareas.Edges oftextsymbols aretypically stronger thanthoseofnoiseor backgroundareas.Thesemethodsoperateessentiallyingray scaleformatanddonotrequiremuchprocessing time. Nevertheless,theydonotcopewithcomplextextimages likepictures ofmagazines orsceneimageswhereedge information aloneisnotsufficienttoseparatetextfroma noisybackground.Theuseofcolorinformation allowsthe imagetobesegmentedintoconnectedcomponents of uniformcolor. A reduction of the color palette is often required. Themaindrawbacks ofthisapproach arethehigh colorprocessingtimeandthehighsensibilityto uneven lightingandsensornoise.Texture-based techniquestryto capturecertaintextureaspects oftext.Inourapproach, the document imageconsistsofseveraldifferenttypesof textured regions, oneofwhich resultsfromthetext-content intheimage.Thus,weposetheproblem oflocatingtextin imagesasatexturediscriminationproblem.Ourmethodfor texttexturecharacterizationisbasedonGaborfilterswhich havebeenusedearlierforavariety oftextureclassification andsegmentation tasks.WeuseasubsetofGaborfilters proposed by Jain andFarokhnia[3]associatedwithanedge densitymeasure.Thesefeaturesaredesigned toidentifytext paragraphs.Eachindividualfilterwillstillconfusetextwith non-text regions but an association of filters will complement eachotherandallowtextregionstobe identified unambiguously. Before characterization, images requirepreprocessing operations. Firstly originalimagesaredownsampled for thewholetext detection process (duetocomputationalrestrictions).This reduction ofpixelsisobligatory mainlytoreducelaterthe executiontime of k-meansclustering. A contrast adjustment is then operated in neither order tonormalize global lightingconditions.Weusea reducedK-means clustering algorithm toclusterfeaturevectors.Inorderto reducecomputational time,weapplythestandardK-means clustering toareducednumberofpixelsandaminimum distanceclassification isusedtocategorizeallsurrounding non-clusteredpixels. Empirically,the number of clusters (valueofK)wassettothree,avaluethatworkswellwith alltestimages. Theclusterwhosecentreisclosest tothe originof featurevectorspaceislabeledas background while thefurthestoneislabeledastext.

IX.PERSPECTIVECORRECTION

When a document is captured by a camera at anUnknownangle,itis ofcourseimpossibleto establisha priori whatishorizontal. However,giventheusuallayoutof western-stylewriting,thehorizontaldirectionisreflected intheimageinthedominantdirectionofillusorylines. A preprocessing stage binarizesthe input text areas computedduringthe textdetection step, turning them into 'blobs'representing eithersinglecharacters or (portionof)wordsorlines.Aninterestingadvantage of this binarization is to analyze only pixels previouslyclassifiedastextandusinganindependent threshold for each textbox which is illustrated in [9].

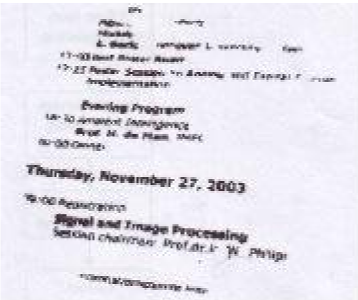

Fig3.Binarization used for document orientation

The lines segmentation procedure is performed in two levels. This first lines segmentation is not accurate enough i n all cases , especially when text suffers from a perspective problem. It is why a second local method is used to segment line after line. For each line previously detected with the vertical profile, a diffusion cone starts on the first blob detected. The line detection evolves incorporating the first blobs detected into the cone. When a new blob is added into the line, the proper ties of the diffusion coe (orientation and aperture) are adapted with the position, the size and the orientation of the last incorporated blob. This local segmentation method enables taking into account text lines with perspective problems .In non-horizontal images the text lines converge in a point called the horizontal vanishing point. We use a fast approximation method to estimate its position. Even without the determination of the vertical vanishing point, this method performs satisfying results in about 80% of non-horizontal document images

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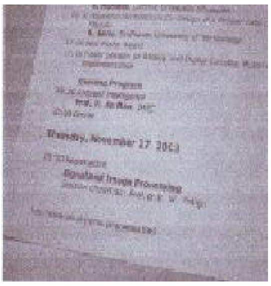

Fig.4.OriginalImag e

Fig.5.Imageafter Perspectivecorrection

X.LAYOUTANDCHARACTERRECOGNITION

The layout of a document is the result of the application of complex, interactive rules about where to place text on the page. But almost all layouts tend to be composed of a number of recurring primitives, text lines, paragraphs and columns. We call the extraction of these primitives physical document layout analysis. The extra ction of higher - level properties of a document like titles or authors is referred as logical document layout analysis. The layout analysisis performed to organize text boxes for a logical reading order. Layout analysis provides in this manner a reading position to every text box. They are later processed independently by the OCR system. We make assumptions of occidental writing systems. Text is read from top to bottom and from left to right. Another assumption consists in the major presence of document images composed of traditional class of layouts like Manhattan textual layouts Text detection areas (binary images) will be transformed in text boxes and labeled in order. Firstly an iterative procedure of columns and paragraphs separationis applied based on the morphological profiles of every binary text box. The separation can be achieved precisely with the detection of gaps in the vertical and the horizontal text class profiles of each textbox. These gaps correspond to undesirable

'Bridges' which link columns and paragraphs together and they are separated. The method to identify two or more columns takes into account the ratios of vertical overlay between textboxes (to detect horizontal alignment) and their relative distance. Finally reading order is decided between the boxes from top to bottom taking in to account detected columns and the layout analysis method has a good estimated efficiency.

XI.FUTUREWORKS

(i)Useofadvanced camera: Pictureswillbemoreaccurate andfinerbyimplementing acamerawithadvanced technologiessuchasanIRcamera.
(ii)InverseA-GPSalgorithm: Positioning errorscanbe eliminatedbyemployingA-GPSalgorithm.
(iii) Noise elimination:the noise occurrencesduring text detection canbeeliminatedusing efficientdenoising techniques.
(iv)Improvement ofaccuracyinOCR:formoreaccuracy bettertechniquescan beusedinOCR,thecurrenttechniques are vast and complicated; work can be made less complicated.

XII.SIMULATIONFORINTERPRETATIONMODE

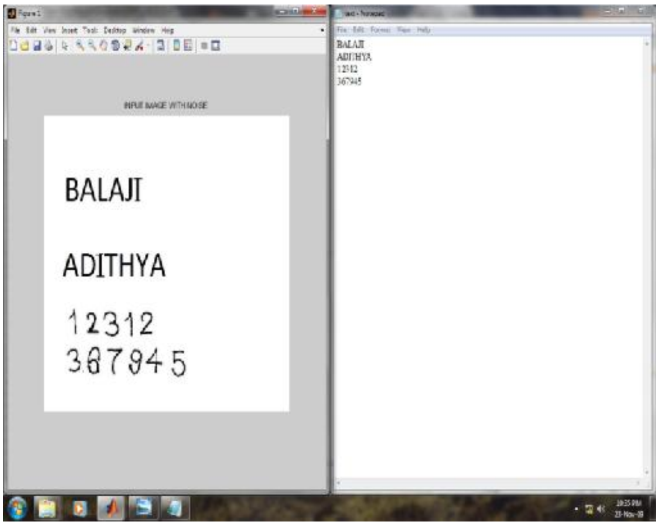

Fig.6.SimulationResultforInterpretation

XIII.CONCLUSION

Thispaperhasdescribedanefficientsystem containsallthe modules whichmakes visuallychallengedmoreindependent, themethodhasbeendesignedincontextofprovidingmobile accesstotextualinformationandnavigation.Textdetection isbasedontexturesegmentation andprinciplesofOCRhas beensimulatedandverified.Themisclassification errorsare oftendetectedduringtheopticalcharacterrecognition. The maincontribution ofworkconsistsofanewandefficient approachforvisually challengedtobeexposedtoboth navigation andinterpretation andgivesthemasenseof distance,direction,evaluationand visualtexture.

REFERENCES

[1]Andrew Y.J.Szeto,SatishK.Sharma,"RFIDbased Indoor NavigationalAid forPersons with severeVisualImpairments"Proceedingsofthe29thAnnualInternational ConferenceoftheIEEEEMBSCiteInternationale,August 23-26,2007
[2]S.Ferreira,C.Thillou,B.Gosselin,"From Pictureto speech:aninnovativeOCRapplication forembedded environment", Proc.ofthe14thProRISCworkshopon Circuits,SystemsandSignalProcessing (ProRISC2003), Veldhoven(Netherlands).
[3]A.K.Jain,F.Farrokhnia,"Unsupervised texture segmentation usingGaborfilters",PatternRecognition,vol.24, pp.1167-1186,1991
[4]V.Wu,R.Manmatha,"Textfinder: anautomaticsystem todetect andrecognizetextinimages", IEEE Trans.on PatternAnalysisand MachineIntelligence,vol. 21, n.11, pp.1224-1229,1999
[5]W.Y.Chenand S.–Y.Chen"Adaptivepage segmentation forcolortechnicaljournalscoverimages" ImageandVisionComputing,ElsevierScience,1998,Vol.16,pp.855-877
[6]Y.Zhong,K.KaruandA.K.Jain,"Locating textin complex colorimages",patternrecognition, 1995,vol28, pp.1523-1535
[7] N.S. BharathKumar, K. ArunKishore, "Sense of Sight, Anaudibleoptics"
[8]A.Y.J. Szeto,"ANavigationalAid forPersonswith SevereVisualImpairments:AnInitialStudy,"*Proc.25th Ann.Int.Conf.IEEEEng.Med.Biol*.,vol.2:1637-1639, Cancun,Mexico,2003.
[9]S.Ferriera,VincentGarin,BernardGosselin," AText DetectionTechniqueAppliedintheFrameworkofa Mobile Camera-basedApplication"
[10]A.K.Jain,S.Bhattacharjee, "Textsegmentationusing Gaborfiltersforautomaticdocument processing", Machine VisionandApplications,vol.5, pp.169-184,1992
[11]"Digitalimageprocessingusingmatlab"byRafael C.Gonzalez,RichardE.Woods,StevenL.Eddins
[12]J.Leventhal."Getting from HeretoThere:AShort Review ofTrekker,"*AccessWorld:Technology andPeople withVisualImpairments*,July,4(4),2003.