A Wearable Brain-Computer Interface Instrument with Aug- Mented Reality-Based Interface for General Applications

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Abstract: In the project we are demonstrating the combined usage Augmented Reality(AR) and brain faced com- puter interface(BI) which can be used to control the robotic acuratorby.Thismethod is more simple and more user friendly. Here brainwave senor will work in its normal setting detecting alpha, beta, and gam- ma signals. These signals are decoded to detect eye movements. These are very limited on its own since the number of combinations possible to make higher andmorecomplextaskpossible.Asasolutiontothis AR is integrated with the BCI application to make control interface more user friendly. Thisapplication can be used in many cases including many robotic anddevicecontrollingcases.HereweuseBCI-ARto detect eye paralysis that can be archive by detecting eyelidmovementofpersonbywearingheadbend.
*Keyword:These Signals Are Decoded To Detect Eye Movements.*

I. INTRODUCTION

Augmented Reality is a technology which is provid- ing information about the real world to the technical system so that system can eassily understand the hu- man behaviour all around the surroundings .In the previous decade AR has gained so much ofpopulari- ty as it become the smooth interface between the thehuman and the technology to understan each other. wecansaythereweretoomanylaggingwiththepre- vious technology which has been overcome du tothe evolution of the AR.In the context of industry,Bos- ton consulting group has identified AR as the nineth piller for the technology to get succeeded inti theon- going industrial revolution.EYE paralyses detection as if the eyelid doesn't

flick within every second and have not mutual coordination among both eyes then itcanbeconsideredaspyramidedone,candidatewill be asked to wear the wearable and take the eye test. Inthetestcandidatewillbeaskedtolookindifferent directionsandthesystemwillmeasuretherotationof both eyes and determine theresult.BCI sensor is connected to raspberry pi through Blue- tooth then the data will be fetched through it.Raw data is processed into parameters in raspberry pi and it will generate some patterns that will lead us to the conclusion of diagnosis. AR application sends commands to raspberry pi then Application com- mands are converted to actuator controls in raspber- ry pi, like this the flow of data will be happan and we will generate many patterns the we have to find interesting patterns using algorithms that we will dis- cuss later in this paper, There is constant flow of data between BCI and raspberry pi and to AR application and back to raspberry pi.

The BCI singleton system would be work but it will show very very less frames in display monitoring for patterns,and it will be too slow because it will take much more amount of time for training the model and generating the patterns.if we use AR with BCI it will be faster in every steps,it will be giving increased frame rates,way much lower model training time as well as patterns are also generate more accurate.
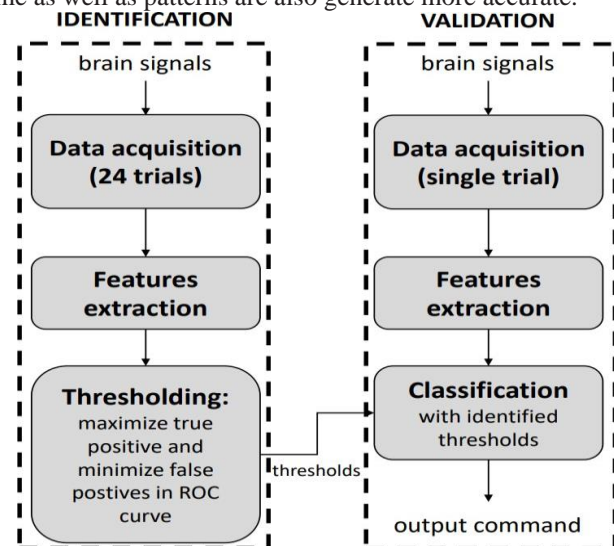
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II. EXISTING SYSTEM

BCI is used in various applications but it's complex slow and impractical in some point, BCI take longer to train their models.it enables the user to interect with computer without any physical movements but it is not implementable because it will take much longer time to train as well as frame rates will be only 5-10. using BCI can control any devices without physical movement,with use of 7-8 electrodes the robotic hand can controlled without any interaction.but to move BCI from laboratory experiment to on paper and from paper to real life implementation is still near- lyimpracticable.more accurate algorithm for online EEG will develop for that.
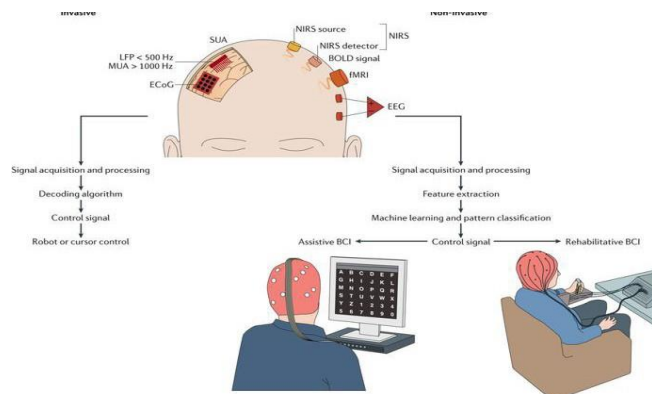
As we can see in above diagram how BCI works and what BCI is,There are 3 types of brain computer in- terface non-invasive,semi-invasive,invasive.but most popular is bi-directional brain computer interface which can do both,stimulating and recording from nervous system signals.We have to feed datasets for training model for brain computer interface. One of the key problem we face while dealing with brain data is that how to feed the data to the system.For example,let us consider, the case of EEg, which are suppose to capture all the input data very acurately .It is the duty for the sensor to collect the data as it will be the only case which are consider for the theoutcomes.As we know the result for the eye inspection will totally de- pends on the movement of eyelids,so it is always tacen care that the data entered for the input must not be referential in the nature.methods has its own merits and demerits.

We all know that the making of scenario for any proj- ect is very simple but the execution is very tough. so that is the same case here too that thr cascading of the code to thr system to understandare very tough tasks to perform.

There are various ways to captured the electrical sig- nal for example ECG,MRI.but there are other ways as well to capture the electrical signal as fmri are used for collecting data for the brain signal which is nuero signal and we can say that each one of the above mentioned

III. PROPOSED SYSTEM

The brain computer interface combined with au- gumented reality(AR-BCI) will be overcome ma- jor issues of brain computer interface.we will use single electrode BCI with AR

for diagnose eye parelysis,with help of this patient can express their emotions to the doctor,the emotions of patient will generate patterns in screen which will be moniter by doctor.the patterns created by brain signal and sub-tractingbraing signal with eye signal using the for- mula.EYE disables detection as if the eyelid does not blink every second and does not co-operate between the eyes of both eyes so it can be considered one of the pyramids, the candidate will be asked to wear a dress and an eye test. Here we will try to optimise our solution and try to reduce the problem which are arising and increase the focal length.

With the help of the single wareframe house we will try to overcome the serious eye fatigue and we will analeys the eye movement as well the nerve signal which are transmitted by nerve cells.

project features are more but we are focusing on only one that is eye paralysis detection because all and each feature use will be needed to train machine learning model to be train according to feature de- tails and behaviour while entire project is depend- ing on machine learning model because that model only give this detection results and it's only design to certain way to that only detects the eye paralysis calculation now for more things to be done we need to train it for that type of feature behaviour or we can develop like multi purpose model that can han- dlemultilple task and features in single model but that requires more time to train and it will be very difficult to develope in shorter amount of time and will decrease the accuracy factor each of the fea-tures rather then single feature model.
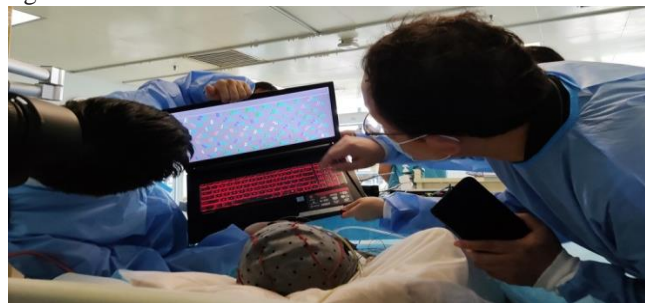
these are the list of featurews which can be develop using this technique: 1)eyeparalysis detection using Brain computer in- terface with Augmented reality wearable device which can detect eye lid movements of paitient and determine whethere user's eye movements when he/she look around is normal or not if it's not nor- mal then it will give calculated risk of that eye lid movement that can be leads to eye paralysis and this method need to where headset that contain electrod with bci and glasses that can be wearable on head of the user and user will be asked to look around and look in certain direction that will user obey the inspection criteria perfectly for best results and then it will be connected through blutooth for readings in unity 3d that will consider headset movement in virtual screen and run python model in backend for calculating the eyelid movements As per above usecase diagram we can see how our AR-BCI physical device will work,
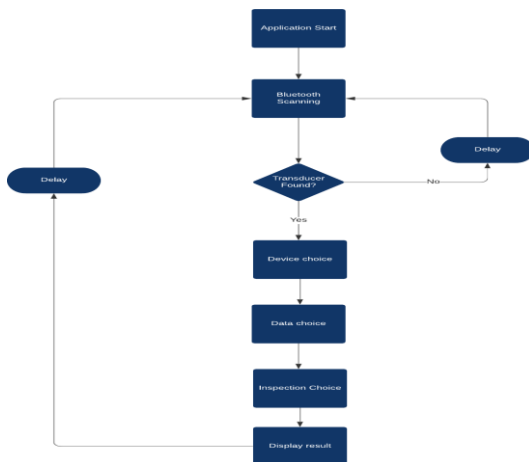
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it will be con- nected through bluetooth, BCI sensor is connect- ed to raspberry pi via Bluetooth and data will be downloaded.Red data is processed into parameters in raspberry pi, and will produce other patterns that will lead us to the conclusion of the diagnosis. The AR application sends commands to the raspberry pi and the application commands are converted into actuator controls to the raspberry pi, so the data flow will be fun and we will produce many patterns that we should find interesting patterns using algo- rithms which we will discuss later in this paper. of continuous data between BCI and raspberry pi and going to AR and back to raspberry pi.

For the design of the headset we have to consider multiple measures for fitting in various age groups head.we are using strips of clothe type material for flexibility and easy to fit and adjust in various head sizes however the main problem comes when the user is wearing eye glasses. when user is wearing

eyeglasses he does not needs to remove eye glasses because it will only cover upper forehead in some case user have some unique eye glass frame then thats ex- ceptional case but generally design is also suitable for eye glasses wearing users we came up with the design that is suitable for glass wearing users and it will only coverup user's forehead like shown in picture it will have carrying pocket on both sides that will contain bluetooth and other sensors underneath that electrode will be there.so augmented reality headset does not require glass because it will only measure brain sig- nals from BCI with electrode in headbend.

Usecase Diagram

As per above usecase diagram we can see how AR- BCI work in physical device, BCI sensor is connect- ed to raspberry pi via Bluetooth and data will be downloaded.Red data is processed into parameters in raspberry pi and will produce other patterns that will lead us to the conclusion of the diagnosis. The AR application sends commands to the raspberry pi and the application commands are converted into actuator controls to the raspberry pi, so the dataflow will be fun and we will produce many patterns that we should find interesting patterns using algo- rithms which we will discuss later in this paper. of continuous data between BCI and raspberry pi and going to AR and back to raspberry pi.

IV. LITERATURE SURVEY

The purpose of this project is to detect eye paralu- sis through the movements of the aeyelids and match it with normal movements value and this will low- er the risk of eye paralysis to be undetected and fur- ther problems will be stopped by this.User have top wear the headband which made by 1 electrode BCI and Augmented reality headset that is connected to software through blutooth that will measure all brain signals and detect eye signals from it then eleminates other dsingles through the algorithm of patterns re- moving that algorithms is quite fast and accuarate that is making this software more fast and accurate. the remaining signal will only of eyes signals then we will ask the user to look in certain directions and when he/she looks in that direction we will give them full report that eye lid movements of their is normal or not if it's not normal then he/she will be hgaving risk of having eye paralysis. the eye paralysis detec- tion using Ar or bci is very unique approach to de- tect and inspectio n with much more effective and accuare method for any inspection therforeBci and augmented reality also are in developing and rising factor of improveement in this project so it will keep evolving it self by evolution of instruments and algo- rithms used in this project. we have to separate the brain signals obtained from the neuron and received by the electrod, we have to determine which signals from the eyes to the brain and find that we will use a special number to combine other unwanted signals and keep only the optical signals to form patterns and find in the python machine learning model interest- ing patterns to give visible and accurate results we should divide the modules into categories: Eye sig- nals, other optical signals. The electrodes will bring back the escaped electrical signals. It will capture all the signals but we will have to determine which ones are eyebrows and which are some of the part markers so we will need an algorithm to separate both with- out splitting this will give more inaccurate results and this project will not be targeted immediately. Thenwe needed a robust algorithm to detect and filter theright number of optical signals on the signals.we will use UNITY 3D 2019.1f version for deter- mining this eye lid movements and all other calcula- tion we can even see simnulation on the unity screen player. when we click on unity player play button it will autometically tries to connect to the headset via bluetooth once it connected it will directly starts to shows datas into the screen the screen will move when we move our eyelids also it will give infor- mation and display it on the screen so we can see whethereconnectionis established or not.if we use other older or newer version of unity with this pro- ject may be it will not run because of unity's other versions then LTS are using some of the deprecet- ed methods and it may not directly work we have   to convert whole project to that version of unity and then we can check if it is working or still we need to change some of the methods.

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while older version of unity was using mono for it's coding and it was good after the new update UNITY 2015.2f they stopped support for mono and added collabration with visual studio for c-sharp scripting and for this project we are using c-sharp scripts for BCI-AR input from begginning then we are receiv- ing data from c-sharp script in unity.we are sending that data after storing it to some database and we aregiving this datas to our machthe application will have 2 buttons that can connect and disconnect the headbend via bluetooth.it will show 4 parameters on the screenSignal strength,attention,meditation,delta and one icon that will indicate the strength of the signal whethere its poor then it will be red color,whethere its yellow then strength is medium,whethere icon is green then it's a good connection between software and the headbend.the icon will be show animation like connecting while connecting to the headbend via bluetooth.the attention will indicate value of move- ments and meditation also shows the value of move- ments according to this values getting this values in for certain time and then data collected from this value and calculated using machine learning model which is written in python and which is responsible for giving results.

Case Study
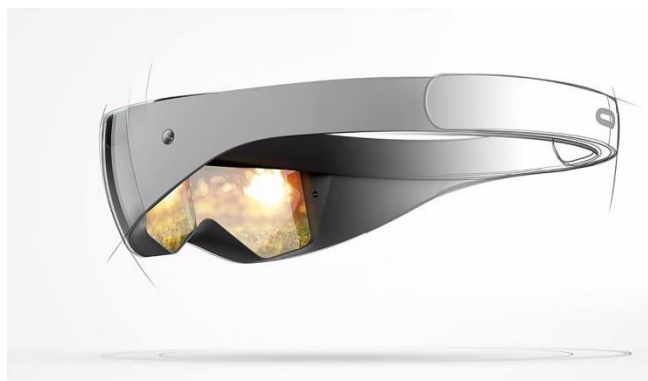
if bluetooth connection hjaving some problem poorc- signal value will shown as increased up to 1400 if the value is 0 then you have great connection between headbend and software which is developed in unity. delta will be for direction of movements while med- itation.attention and delta are directly perportional to the movements of eye lids and meditation data we have to sent to the backend machine learning model which is developed in python.In designing the headset we should consider many equity measures for differ- ent age groups.we use cloth type straps to be flexible and easy to fit and adjust to different head sizes but the biggest problem comes when the user wears eye- glasses.when the user wears glasses he does not have to remove the glasses because will only cover the up- per forehead sometimes the user will have a different eye frame in which case the case is different but the standard drawings are also suitable for user- assisted eyeglasses with a design suitable for wearing glasses and will only hold the user's forehead as shown in the image on both sides which will have bluetooth and other sensors under that electrode. it needs glass because it will only

measure brain signals from BCI with an electrode on the headbend.so is very different from the reality and points above a picture of the dif- ference between augmented reality headbend and a virtual reality headbend.security in this techline is most required because its newly arrived tech and many security traits are yet to detect so we are using brain computer interface from that we can know the data of someones brain signal pattern in future technologies are growing that migth contain lock using brain patterns and many moprecould happen we dont know yet because security it the thing in which we must keep evolving ourselves to stay protected even the attackers are also keep evolving break every new security line ups but for this is for now its safe to use because we are not storing any data to the servers and all we just store temporary data.

that too will be destroyed after us- ing the app and generating the report however the machine learning model will keep learning from the all user's data and it will improve accuracy by passing the time and data so that will asked in terms and condition before usingh the application or the software. For this BCI-AR device, we need high precision to manage augmented reality load-bal- ance that we will use Unity SDK of BCI for this project which will require a minimum of 8 GB of well-developed games but when it comes to realistic tests and projects it will require at least 16 GB ram to operate smoothly low but won't work smoothly than before.The AR app con- tains many platforms like Vive Nest, Inactive Engine, Steam Vr these are the best programs that use the unpopularity we see in reality.
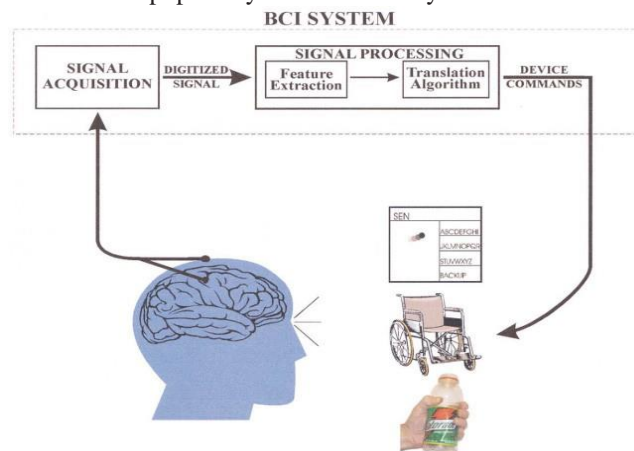
The above diagram shows how doctors are trying to use the bci for
examine and communicating with their petient.Thebci system with fetch signals from the brrain and will respond to each pattern of that signals and it will create some interesting patterns that will help us to communicate and understand what petient wants to communicate with doctor.

V. RESULTS

The conclusion is we can develop endless innovative ideas with brain computer interface with augment re- ality but it's quite challenging to implement cause its current growing technologies and very small com- munity they have so if we stuck in any moment we have to find solution our selves.but eye paralysis de- tection can be more better in future when communi- ty is grown as well as more updates from hardware side given.this technique can be used in many way to communicate with doctors to patient like wise in eye paralysis detection is simplfy by this method because small details can not be catched in normal way but using this way we can catch eye paralysis even small one too.because it ios using direct brain signals to detect eye movements. Here we will try to optimise our solution and try to reduce the prob- lem which are arising and increase the focal length. With the help of the single wareframe house we will try to overcome the serious eye fatigue and we will analeys the eye movement as well the nerve signal which are transmitted by nerve cells.we reduced the eye fatigue and eye strain while use with stimuli pa- rameters that stops the process while ideal for long. we need to specify the type of 3d unity to con- nect our wireless virtual wireless to the unity platform and get navigation details and other data that we will use to test that model. The aim of this project is to detect eye defects by mov- ing the eyelids and to match the normal num- ber of movements and this will reduce the risk of cataracts being detected and other problems will be stopped by this. The user has mounted a headband made of 1 electrode BCI and aug- mented reality headset connected to a Bluetooth software that will measure all brain signals and detect optical signals from it and delete other measurements with a pattern algorithm that re- moves that algorithms are faster and more ac- curate. more accurate.The remaining signal will only show eye signals then we will ask the user to look in certain directions and when looking in that direction we will give them a full report of whether or not eye movements are abnormal if you are at risk / you will be at high risk foreye impairment.The eye disables the discovery as if the eyelid is not shining all the time and does not co-operate between the eyes of both eyes and therefore can be considered as a pyr- amid, the enlisted person will be asked to wear a dress and an eye test.In the test, the candidate will be asked to look in different directions and the system will measure the rotation of both eyes and get the result.Another test is the diagnosis of Brain hemorrhage with the help of blood pres- sure measurements.In this test the blood pressure of the person to be counted will be estimated at 1 minute and then tested on normal values and then fully tested.Visually impaired visual acuity using Ar or BCI is a unique way to find and evaluate where there are more effective and efficient ways to detect any Bci tests and the unpredictable re- ality of taxpayers we see is still developing and enhancing the evolutionary nature of this pro- ject and therefore will continue to evolve. with the tools and algorithms used in this project.The remaining signal will show the eyes only when we ask the user to look in certain directions and when looking

in that direction we will give them a full report of whether the eyelid movement is normal or not and if that is not the case you will be at risk of eye paralysis.the need to focus on the icon while creating the task of testing, and (ii) the need to look at the icon in advance.

VI. CONCLUSION

The program, which includes realistic mirrors that e unpopular with taxpayers we see through interface- for single-channel single-channel brain-computer based on SSVEP, proposed to apply to perform tests functions, receiving data from an external wireless transducer networks, and free hands in other related activities. An a meteorological test design was per- formed check and increase real-time metrological performance of system.

Additional verification tests were performed eevaluation work done in Industry study 5.0. Test results show a minimum the time to In future scope is to fasten the algorithm to make out more frame rates as well as more accurate sig- nal filtering and to use this technology to detect not just eye paralysis but multi purpose / multi inspec- tion device that can detect multiple diases in our body,this technology will be used in many project and future innovation because it connects our brain signals to visual.it can show even our emotions into the screen,it will show how we feel in to screen but those projects are still in progress and development in future Augmented reality and brain computer in- terface surely take advantage of many opporchunity. we will use neuro feedback for improving accuracy that feed back will ba receive every time we make request and that feedback gives us the data / infor- mation about processed data so we can analyse and alter that for better accuracy.

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