

Methodology outline

01 Data Collection

This category requires the collection of the physiological and neurological data with the aid of non-invasive sensors.

- EEG Data Collection:** To gather the signals of the brain waves in order to observe the activity of the brain. Position the electrodes on the scalp like IEEG ensuring the right locality to get the signals.
- Cortisol Level Monitoring:** These Devices, as part of dynamic artificial cortisol replacement therapy for patients, continuously register cortisol salivary levels as physiological indicators of stress. Real-life task: A cortisol sensor (such as a skin patch or saliva collector) is worn to collect the information physically.
- Environmental Data:** To collect such information that describe the environment where the participants carry out the task such as the temperature of the room.

02 Software Analysis

The particularity concerns data interpretation with a view to establishing patterns which subsequently render the management useful.

- Signal Processing:** Recognition of EEG pattern configuration of the subject during stress or stress seizures which is an abnormal condition. To use either Fast Fourier Transform or machine learning models based signal classification.
- Programming languages:** Python (MNE, NumPy), MATLAB or C++.
- Data correlation:** It will help in validating the patient particular information with the EEG and the cortisol data collectively against such events with regards to stress or any brain activity or other health related issues.
- Alert Triggering:** An alert is raised when operating in the idle condition and if the readings from the EEG synthesizer or cortisol synthesizer are out of the normal range.

03 Real-Life Implementation

This category is about putting the system to use for patients' safety and care in the real world.

- Patient Attachment:** Purpose: Make certain EEG as well as cortisol sensors are set in the appropriate position as well as placed in the proper order. Reality Task: Source the before for the Cortex Monitor for installation for constant and precise measurements.
- Continuous Monitoring:** Purpose: Look around the data passively while leaving the patient to take care of their daily chores or activities. Reality Task: Work on the equipment that would allow the above to be done without any obstruction.

A lot of applications can be found in our project to begin with, we can connect the wires and the whole system with some kind of hats As shown in Fig (5) which can be a permanent part of the life of the patient and avoid any obstacle of moving around among people, the next application that we can get the benefit of is to connect The system with another Bluetooth system that will be at the ear of any person who will take care of that patient

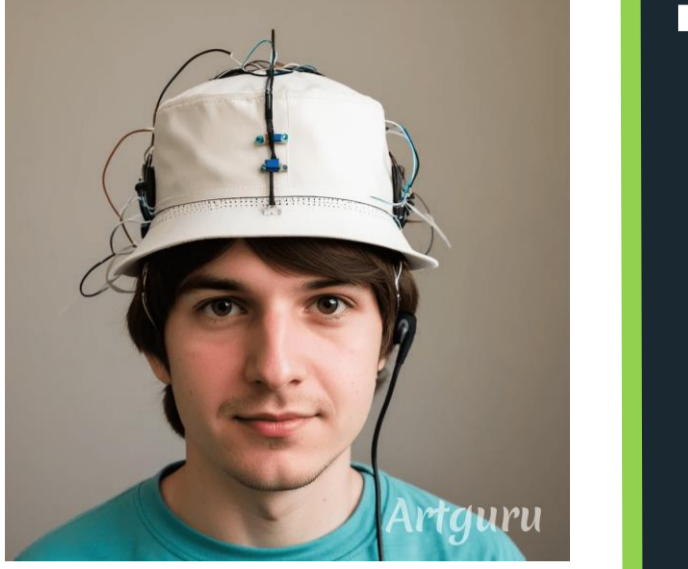


Fig (5): EEG Hats

The system with another Bluetooth system that will be at the ear of any person who will take care of that patient to be aware of any sudden action could happen to the patient mental health.

The study finds that the suggested idea improves the purpose of EGG by identifying the types of brainwaves, emotions and any type of negative elements. This scalable solution does not involve substantial modification of software or code embedding into the medical structure of the EEG. It offers complete medical care to people suffering from ailments related to brain, as it cuts down the time and money spent on frequent trips to the doctor and speed up the process of identifying diseases. The code of the system was elaborately checked to ensure its correctness as well as reliability and thus it is a cheap and effective device for regulating the health of the brain.

Some concerns were taken through our project, so we have some advice which we recommend for anyone to do in any future operation in our project. User Training and Support: Proper training for users, whether medical professionals, researchers, or patients, is very important to guarantee the effectiveness and safety of using the EEG system. Adaptability to different environments: The system must be able to work in a variety of settings, like hospitals, home care, and research labs. This includes consideration in design for wireless and/or battery-powered options and the ease of use by non-expert users, including caregivers or the patients themselves. Portable EEG System: In our application, a portable version of the EEG system is highly recommended. Its small size, easy transportation, and flexibility in use make it much better. In sum, attending to these added recommendations will enable future versions to more surely achieve both safety and efficacy.

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Johns Hopkins Medicine. (n.d.).Electroencephalogram (EEG). Johns Hopkins Medicine. Retrieved December 29, 2024, from <https://www.hopkinsmedicine.org/health/treatment>

The estimate provided by WHO in 2019, suggests that in the USA alone, when just mental illness is regarded, there is approximately around 450 million target group, wherein one among four is likely going to face this issue in their lifetime. It has been established that mental disorders encompass a broader perspective comprising of cognitive, emotive or even behavioral disturbance resulting in distress and dysfunction, and abuse as far as weak and unhealthy individuals are concerned, the effects are far more damaging such as death.

An example would be an EEG whereby its interpretation is deemed to be a complicated and lengthy process. The system targets people with special and chronic illnesses who have difficulty communicating;

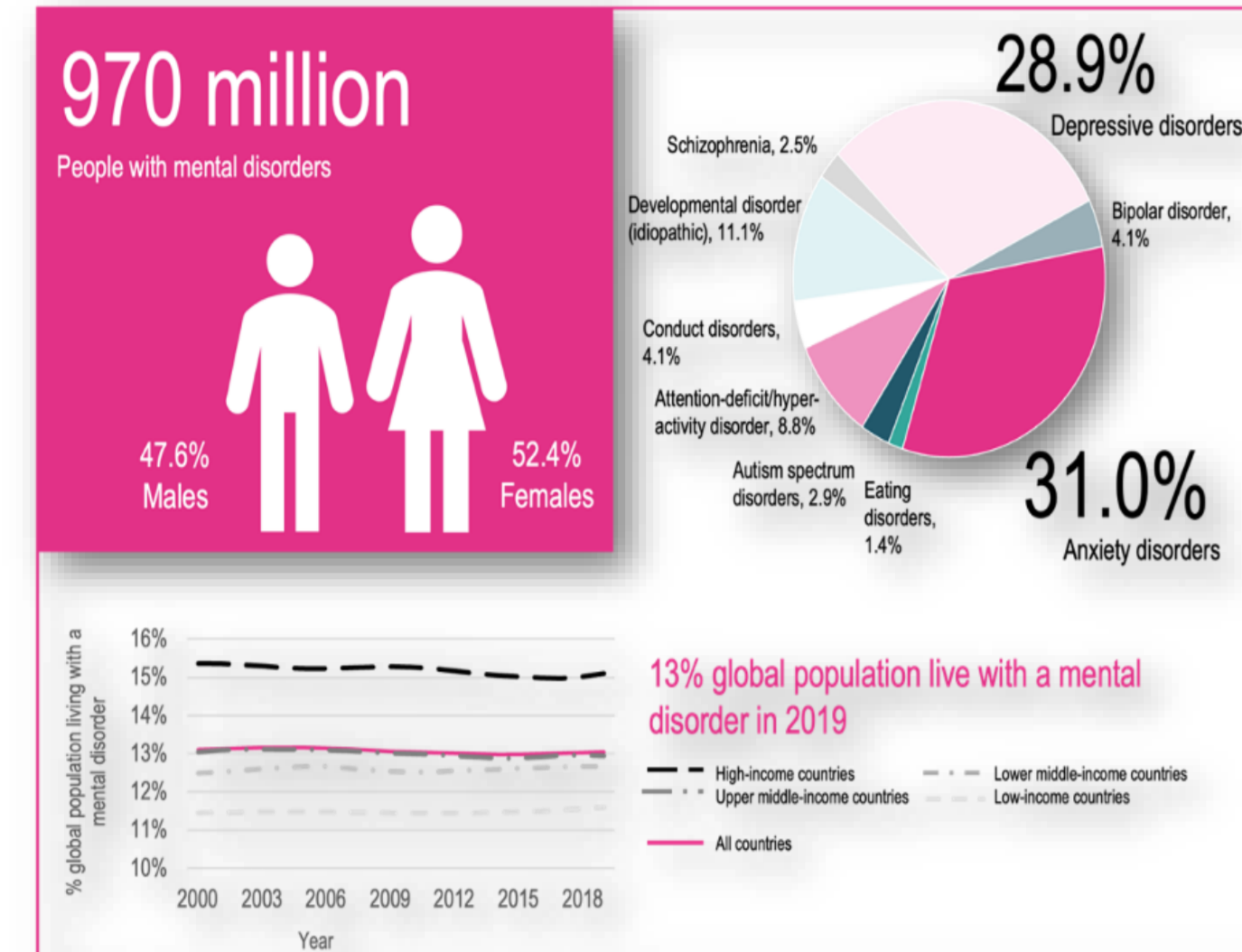


Fig (1): The percentage of people that suffer from mental disorders in 2019

as a result, the aim is to achieve a non-destructive methodology of intervening so that healthcare can be conducted easily. The system contains a brain-computer interface, includes various sensors including cortisol measurement and other tailored software. This includes abnormal EEG signals and cortisol levels which help to indicate stress and other health conditions. So, intervention occurs via mechanisms such as Bluetooth thus allowing the update of caregivers or mobile devices and thereby extending the possibilities of intervention. The system acts as a cost-effective and portable medicine thereby easing the intervention process by continuously monitoring the health of the individual and raising alarms in case there is a divergence from normal health indicators.

- Realizing the predicaments that people with special needs and mental disorders face, as the problem was defined as a catastrophe that needed to be assumed.
- Understanding the working mechanism of the EEG and how could doctors get benefit of this device determining the condition and the diseases of any patient.
- Learning more about mental disorders and disability that affect the brain and how could doctors deal with such conditions
- Analyzing the data coming out of the EEG device including waves and monitoring any unusual disorder in these waves
- Devising a code system that can analyze, indicate and organize the condition of the patient based on the waves and data input from the EEG device
- Devising and explore future enhancement and features for the project including the applications, the interface ..etc.

Resources

- python™ Programming language
- Visual Studio Code Code Editor
- OpenNEURO Neuroimaging database
- World Health Organization UN agency
- JSON Open standard file format
- Bleak Library for working with BLE devices

Analysis

The suggested technology provides gentle, constant monitoring for patients with disabilities or chronic diseases, using simultaneous EEG as shown in Fig (2) and cortisol measurement for better health evaluations and early detection and alerts. As shown in Fig (3) However, there are difficulties such as technical installation, costs and training of caretakers, but it creates chances to lower the cost of healthcare, increase the availability of remote services and have the scale for different diseases. Focusing on such threats such as breach of data, poor connectivity and barriers by regulatory authorities will be essential, but overall, systems of this sort can change the face of the healthcare delivery system as well as enhance equality in care provision.



Fig (2): EEG device

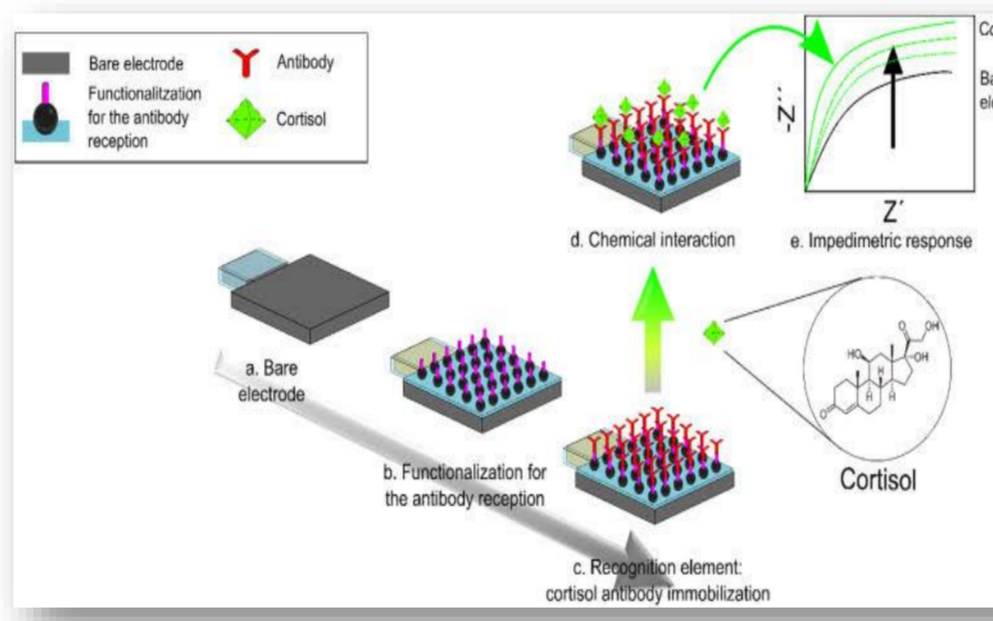


Fig (3): cortisol sensor structure

```
def detect_patient_stressing_frequency():
    # EEG Data Collection
    # Cortisol Level Monitoring
    # Environmental Data
    # Alert Triggering
```

Results

- Goals of the System:**
- Increased Protection for the Patient:** There is vigilance maintained seamlessly with potential abnormality of brain activity and any physiological change. Alerts being given in time provide caregivers an opportunity to take action before a circumstance deteriorates, thus preventing complications.
 - Enhanced Living Standard:** People with chronic illnesses or with special needs are able to benefit from a passive monitoring system. Patients are given anticipatory care even in situations where they are unable to verbalize discomfort.
 - Reduction in Workload and Stress within the Caregiving Free:** Through automatic processing of EEG and cortisol information there is less reliance on manual supervision. There is communication over Bluetooth which helps in quick response hence fast action being made able to relief stress.
 - Effortless Disease Forecasting:** The incorporation of EEG and cortisol data leads to the appropriate estimation of stress related or neurologic disorders. Identifying a combination of basal EEG patterns with time removing from the end of an extremes and removing degradation input helps to identify some new health problems as well.
 - Reduced Supply of Healthcare Services:** The system cuts the need for regular physical supervision, which reduces most expenditure on care services. Prompt detection of the problem halts expensive remedies for chronic diseases.

Impact

Healthcare Impact of Our Project:

- Cost Reduction:** With Global spending on health care exceeding \$4.4 trillion dollars in a year and personal spending on health care per capita at around \$10,805, it suffices to say that most of the cost of conducting patient medical operations and health checkups could be reduced through effective disease screening coupled with decreasing the waiting time for the treatment of patients.
- Improved Survival Rates:** Provision of timely detection of diseases that regards as input will significantly reduce acute conditions of the patients. This enables doctors to treat patients at their best time, which positively contributes to the patients' survival rates.
- Addressing Inequality:** The gaps in mental health spending such as the ratios in high income where as much as 5.4% is spent but only 2.1% as shown in Fig (4) in impoverished and middle class countries will be closed. It ensures provisions of hassle free low cost telemedicine to lessen the pressure on poorly funded healthcare systems.
- Long-Term Impact:** Inequalities in healthcare are likely to be narrowed down by about 20 -30 % after a period of 10 years which is expected to promote better mental health and life satisfaction for the patients. A more efficient and fair healthcare system is being developed by altering the patient experience of detection and treatment of diseases.

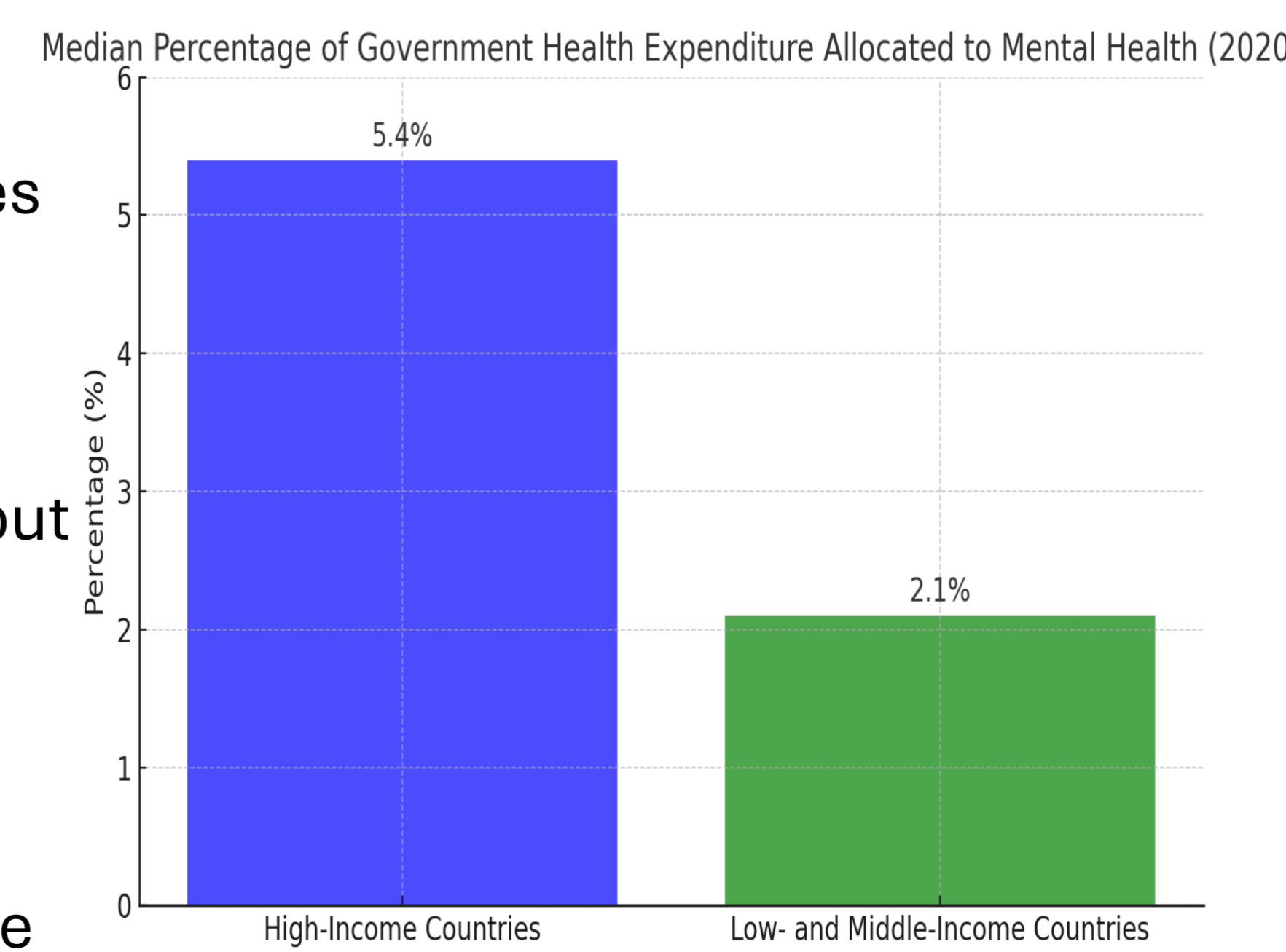


Fig (4) : the median percentage of government health expenditure allocated to mental health in 2020, comparing high-income countries (and low- and middle-income countries).