

EEG-based Brain-controlled for Automatic Operations on Wheel Chair

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ABSTRACT

Paralysis is the point at which you can't move certain pieces of your body after something turns out badly with their connection to your brain. It comes in various structures and can be brief for lasting or even go back and forth. However, regardless of whether an individual's paralysis is not treatable, their doctors and physiotherapists can suggest assistive technologies, remedial medications, or different systems to help improve personal satisfaction. Therefore, we are proposing a novel IoT based Brain Controlled Mobile Robots which is capable of improving the patients satisfaction by automatic operations on wheel chairs based on EEG signals. This project is implemented using Raspberry Pi and Python as language.

KEYWORDS

Wheel Chair, Preparing and Strategy, Wide Scale.

A General System

The IoT and its applications are turning into a reality, with a few business players creating imaginative items in an assortment of fields, for example, home robotization and smart cities. These items are beginning to arrive at end clients, who are presently getting mindful of the coordination of physical and digital worlds. The gauge of billions (or trillions) of associated gadgets in future years is continually being affirmed and can be equitably.

considered as a fact. The "dash for unheard of wealth" of the IoT time, driven on one hand by the will to show the plausibility of interconnecting regular gadgets to individuals and, then again, by the expectation to make custom arrangements into guidelines for public use, has made a plenty of shut vertical arrangements. This is prompting a profoundly divided market, a babel of inconsistent arrangements, instead of an exceptionally interoperable climate, which is the thing that the Internet and the IoT ought to resemble.

Communication is the critical part for any IoT design and it is liable for gadgets conversing with one another and sharing and trading information. The communication can either occur through a wired or remote medium. In this and the following section, we cover different sorts of remote communication technologies and investigate programming characterized radio. Managing the security device in the wearable device its positive and negative impacts are discussed and the potential threats to the individuals is also highlighted [1]. From the scientific methodology, the objective of automatic voice recognition is to calculate the best possible word sequence W , given the communicated speech signal X , where optimality refers to increasing the a posteriori probability.

Cloud Techniques Used in Health Monitoring

Large amount of people behavior in the world can be handed by big data and IoT Technology since in many countries there are lack of medical professionals to address the patients immediately [2]. In the present scenario disease prediction is one of the main factor of concern for the medical professionals even for the predication of heart disease the machine learning models are used [3]. Many new cloud and IoT technology is used in monitoring serious disease like diabetes and UCI repository data set for people affected severely. [4]. Many classification and regression algorithms are used for the availing better service to millions of people who needs health care service through the

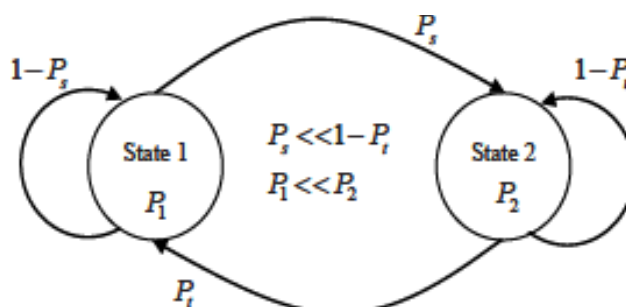
cloud and mobile service [5]. The concept of fog computing is used at the smart gateway. A model is proposed that uses advanced embedded datamining techniques uses for the notification service [6]. Smart home monitoring especially the elderly people or with disability to have a health life. A smart home and home health, monitoring system is developed [7]. Child activity is monitored using the wearable devise on the child and analyzed using the machine learning algorithms [8]

$$\hat{W} = \underset{W}{\operatorname{argmax}} P_{\Lambda, \Gamma}(W|X),$$

$$P_{\Lambda, \Gamma}(W|X) = \frac{p_{\Lambda}(X|W)P_{\Gamma}(W)}{p(X)},$$

$$\hat{W} = \underset{W}{\operatorname{argmax}} p_{\Lambda}(X|W)P_{\Gamma}(W),$$

Accomplishment in utilizing this product relies on appropriate equipment, preparing and strategy.



There are extensively three classes of discourse acknowledgment applications. Indisconnected word acknowledgment frameworks each word is verbally expressed with stops when it, so end-pointing methods can be utilized to recognize word limits dependably. Second, profoundly obliged order and-control applications utilize little vocabularies, constrained to specific phrases, yet utilize associated word or ceaseless discourse. At last, enormous jargon constant discourse frameworks have vocabularies of a few hundred words, and sentences can be discretionarily since quite a while ago, spoken in a characteristic design. The latter is the easiest to use yet in addition the most testing to execute. Be that as it may, the most exact discourse acknowledgment frameworks in the exploration world are still extremely moderate and costly to be utilized in viable, enormous jargon non-stop discourse applications on a wide scale.

Internet of Things

Bluetooth and BLE

Bluetooth is a standard wire-swap communications protocol fundamentally intended for low-power utilization and short communication ranges. The transmission range is power subordinate. On top of the actual layer, interfacelayer administrations including medium access, connection foundation, mistake control, and stream control are given. The upper coherent connection control and transformation protocol provides multiplexing for information channels, discontinuity and reassembly of bigger bundles. The other upper layers are the Generic Attribute Protocol, which accommodates effective information assortment from sensors, and the conventional access profile, which takes into consideration setup and activity in various modes, like promoting or checking, and connection inception and management.

Firmware

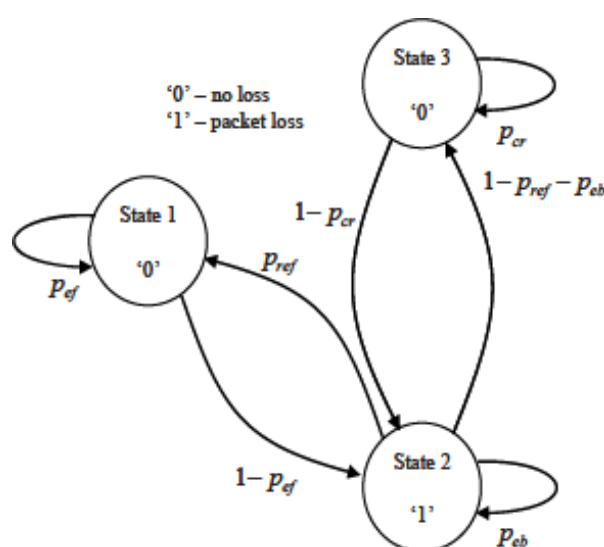
The template is used to format your paper and style the text. This controls the different segments on the gadget and is answerable for every one of the activities on the gadget. You can consider it the segment that holds the keys to the realm. Essentially anything that you can envision that could be removed from the gadget can be found in the firmware. The part devoted to firmware in this book strolls you through what firmware is, the internals, the

different weaknesses we can discover in firmware, and how to play out extra examination on the firmware.

Transport Layer

IoT situations commonly call for energy-efficient, lightweight, and non-CPU-concentrated ways to deal with communication. This is an aftereffect of the restricted abilities of brilliant articles. For these reasons, User Datagram Packets is the regular decision for transport-layer communication in the IoT. Obviously, this decision brings about the inconceivability of appreciating the decent highlights that Transmission Control Protocol gives, like retransmission, requesting, and blockage control. These should be executed in a higher layer if necessary by an application.

Discourse input is likewise by and large hampered by acoustic obstruction and has stayed juvenile for some applications. A couple of ones, similar to machine or terminal orders, have been presented as of now yet get rather low acknowledgment from daze clients. Specialized methods for conveying discourse interface arrangements ordinarily consolidate an intelligent part and a correspondence part. In the previous, the usefulness is gotten for the most part by methods for an organized exchange.



Details of Proposed Operations

Bit stream-based procedures for hearty acquire discourse acknowledgment parameters straight forwardly from the bit stream transmitted to the beneficiary over computerized portable systems. The contrast between bit stream-based systems and strategies that work on the decoded discourse is that bit stream-based procedures stay away from the progression of reproducing discourse from the coded discourse parameters. These incorporate component changes from the element portrayals utilized in the discourse coding calculation to the element portrayals utilized and systems for highlight remuneration in the bit stream space. Besides, the presence of systems situated clamor sources, for example, discourse coding mutilations and channel transmission mistakes has prompted the advancement of remuneration procedures in the sign space, highlight space, and model space. A concise outline of the procedures produced for the bit stream-based methodology and the system arranged clamor remuneration is given here. This technique is best for Paralysis patients who rethespeaker included regularly utilizes long sentences. This strategy isn't appropriate for a Paralysis patient acknowledgment that utilizes short words. The last mentioned, anyway utilizes the probability proportion approach. The probability proportion is characterized dependent on two circumstances to quantify the style of discourse spoken.

The principal probability is the acoustic information that could add to the acknowledgment of the speaker and the subsequent probability is the patient's could be a fraud. The standardization dependent on the back probability was additionally examined. The distinction between the standardization dependent on the proportion probability and the back probability is to guarantee that the asserted patient is recorded for standardization [10]. In view of tests complete

d,bothof the strategies acquire nearly a similar degree ofadequacy.

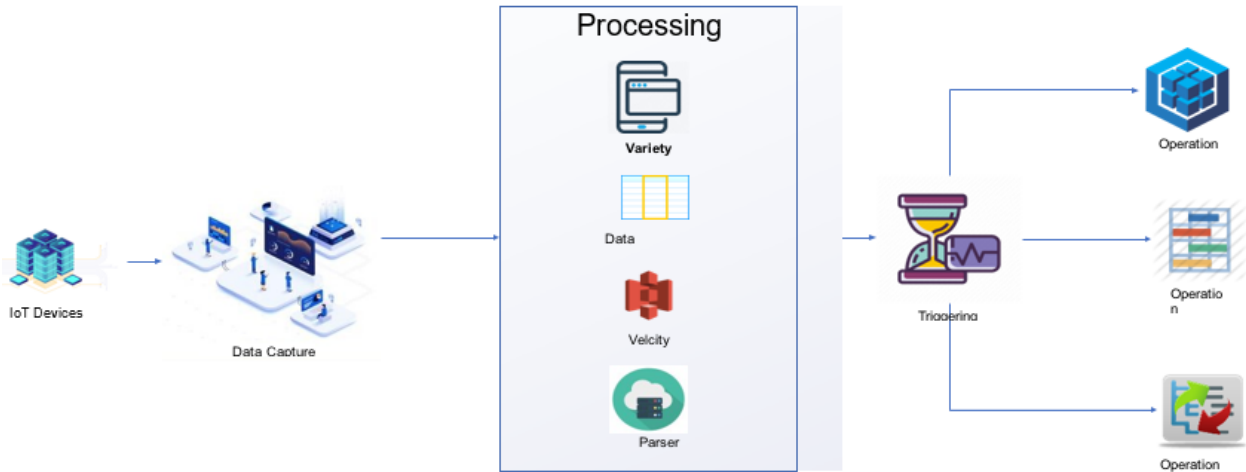


Figure 1. System Architecture for Brain signal Processing

SerialProcessing

TheUno has a different processor that goes about as a USB-to-serial interface. Just as electrical contrasts in the serial sign, the USB transport additionally has a significantly more muddled protocol than serial thus it does a reasonable piece of work in the background so it seems the serial port of the ATmega328 is discussing straightforwardly with your computer. TTL Serial has a generally short reach (a couple of feet), particularly in the event that you use it at a high baud rate. For conveying over longer distances, an electrical standard called RS232 has been characterized. The Serial protocol and a large part of the wording around it traces all the way back to the beginning of computer networking. Both the sender and beneficiary need to concur on a speed at which to trade information. This speed, called the baud rate, is set at both finishes before communication starts. The baud rate is the quantity of sign changes each second, which would be equivalent to the quantity of bits each second, were it not for the way that a byte of information may have start, end, and equality bits.

Experiment Results

Brain controlled mobile robots need more safety because it is used by people who are sitting on the wheel chair. The proposed device is applied on the participants and the overall all driving performance of the wheel chair is found to be improved especially in terms of robustness. The evaluation of these experiments can be seen from the figure 2, figure 3 and figure 4.

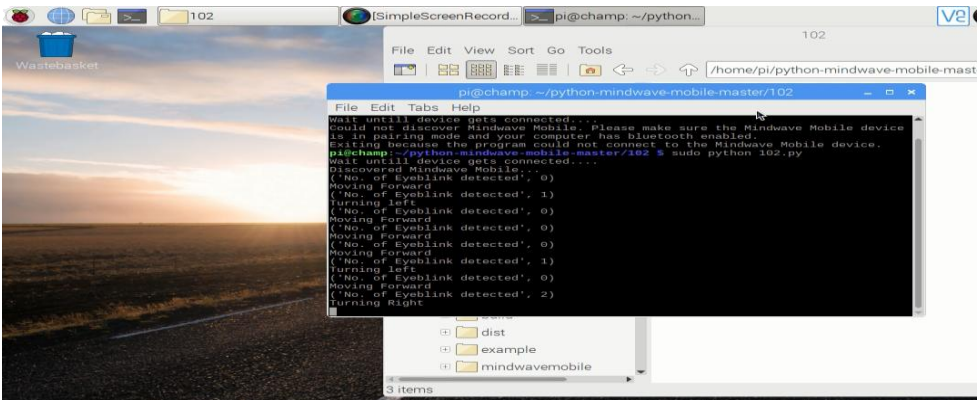


Figure 2. Output of results from sensor

The pattern of brain signal with different amplitude and frequency is shown in **FIGURE 3**.

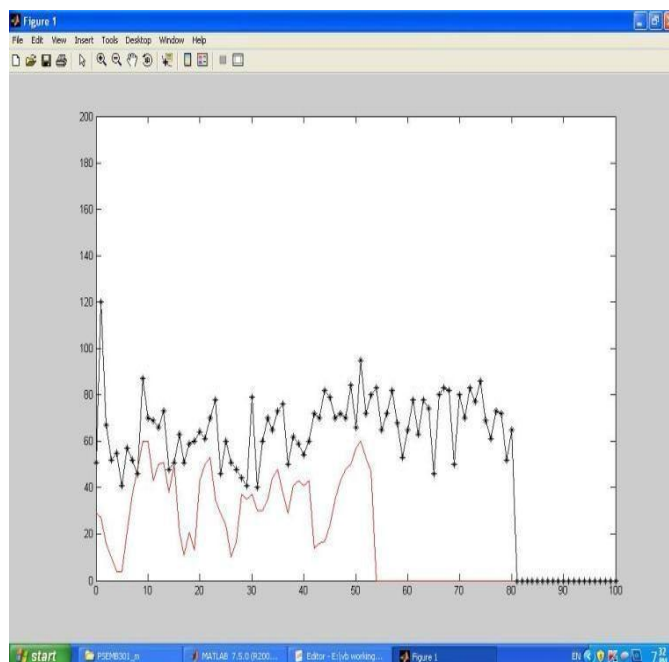


Figure 3. Analysis of brain control mobile robots



Figure 4.EEG devices evaluation with participants

Testing and Evaluation

The BCI that is used for straight communication between the brain and the wheel chair is integrated with hardware and tested as shown in figure 5.

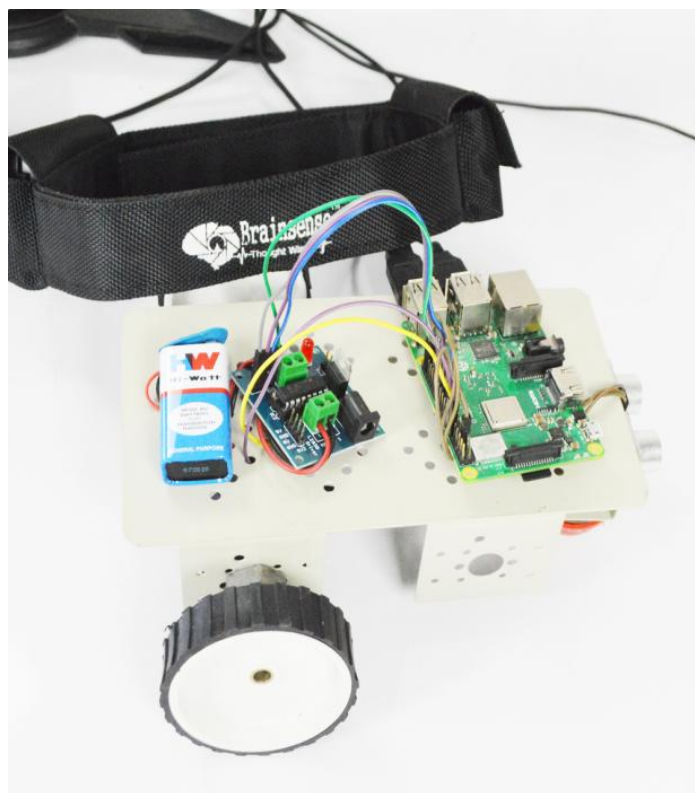


Figure 5.Hardware in BCI

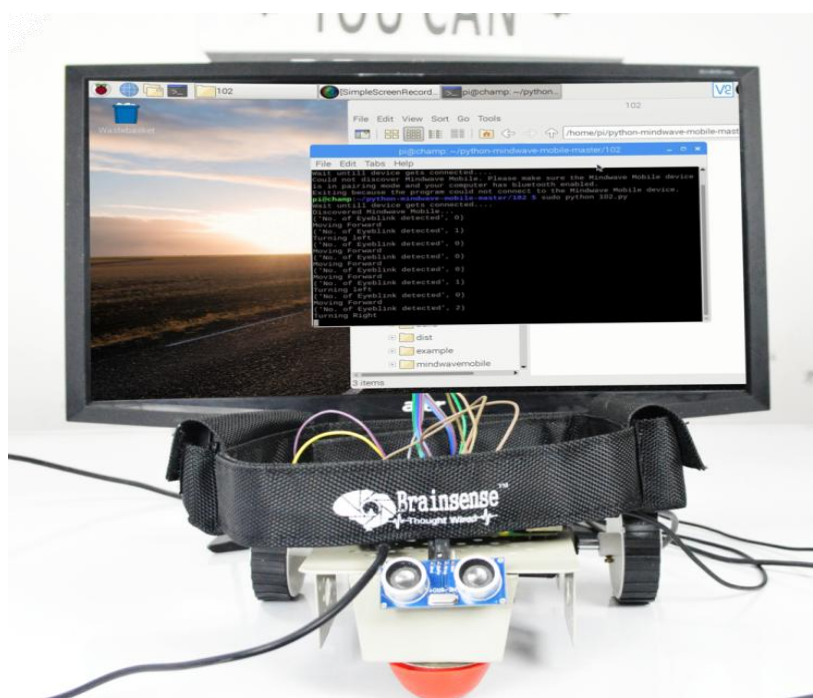


Figure 6. Capturing data through BCI.

The value taken for attention is the blinking of the eyes and this is connected with the BCI. The data received from figure6 is captured and shown used for testing.

Conclusion

One fundamental general end the writers wish to share is that the effectively demonstrated discourse corresponded directly to ceaselessly developing as far as inclusion, of passing on data and of interfacing circumstances in day by day life for the Paralysis patients and adding to generous mitigation of numerous significant obstructions. The multiplication of different IoT devices for every one of the circumstances to be secured is an issue that ought to be taken care of by methods for a more grounded inclination for specialized assembly of various electronic methods in a decreased number of gadgets: potentially one communicator gadget will do a large portion of the versatile work later on. Availability, mindful structure and advancement is the primary rule that ought to be fortified to permit answers for be dispersed among producers and specialist co-ops so openness might be consistently conceded in any event in the open conditions, offices and assets.

References

- [1] A. Marrington, D. Kerr, and J. Gammack, *Managing Security Issues and the Hidden Dangers of Wearable Technologies*. IGI Global, 2016.
- [2] Kwok Tai Chui, Ryan Wen Liu, Miltiadis D. Lytras, and Mingbo Zhao, "Big data and IoT solution for patient behaviour monitoring", *Behaviour & Information Technology*, pp. 1-10, 2019.
- [3] Ganesan, M., and Sivakumar N., "IoT based heart disease prediction and diagnosis model for healthcare using machine learning models", *In IEEE International Conference on System, Computation, Automation and Networking (ICSCAN)*, IEEE, pp. 1-5, 2019.
- [4] Priyan Malarvizhi Kumar, S. Lokesh, R. Varatharajan, Gokulnath Chandra Babu, and P. Parthasarathy, "Cloud and IoT based disease prediction and diagnosis system for healthcare using Fuzzy neural classifier", *Future Generation Computer Systems*, vol. 86, pp. 527-534, 2018.
- [5] Adel Sabry Eesa, and Zeynep Orman, "A new clustering method based on the bio - inspired cuttlefish optimization algorithm", *Expert Systems*, vol. 37, no. 2, e12478, 2020.
- [6] A. M. Rahmani, T. N. Gia, B. Negash, A. Anzanpour, Azimi, M. Jiang, and P. Liliberg, "Exploiting Smarte-Health gateways at the edge of healthcare Internet of Things: a fog computing approach", *Future Generation Computer Systems*, vol. 78, pp. 641-658, 2017.
- [7] L. Liu, E. Stroulia, I. Nikolaidis, A. M. Cruz and A. R. Rincon, "Smart homes and home health monitoring technologies for older adults: A systematic review", *International Journal of Medical Informatics*, vol. 91, pp. 44-59, 2016.
- [8] Yuvakishore, Krishna, V., Charan, S., Jeyaprakash, T., Ranjana, P. 2020, Detection of child abuse activities using machine learning algorithms (DCAAML). *Journal of Advanced Research in Dynamical and Control Systems*, 2020, 12(5 Special Issue), pp. 994-1000.