# A Brain Controlled Robotic Hand by using Brain Computer Interface (BCI) Technology

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***Abstract*:- This paper presents a brain computer interface (BCI) to control a robotic arm by brain signals. The following signal processing steps were established acquisition of brain signals by electroencephalography (EEG) electrodes, noise reduction, extraction of signal characteristics and signal classification. Reliable brain signals were obtained by the use of the Emotive EPOC commercial hardware. The experiments were conducted with and without hearing and visual noise art facts to find out the noise influence in the signal classification outcome. The obtained experimental results presented efficiency in the identification stage up to 100 % with and without hearing noise conditions. The paper was conducted with and without hearing and visual noise to find out the noise influence in the signal. The brain-computer is used to monitor the brain waves of the human and drive the robot as per the thought of the user. The advantage of this solution is that the EEG pulse located on the user's head and the user can wirelessly control the robot. The data read by the EEG sensors are transmitted to the robot section using the Bluetooth transmitter. The Bluetooth value receives the signal and drives the robotic arm accordingly.**

***Keywords—Robotic Hand, Arduino Uno Microcontroller, Bluetooth Tx & Rx Module, Servo Motor and EEG Sensor, Embedded C, ARDUINO IDE.***

## 1. INTRODUCTION

The history of brain-computer interfaces (BCI) starts with Hans Berger's discovery of the electrical activity of the human brain and the development of electro encephalography (EEG). In 1924 Berger was the first to record human brain activity by means of EEG. Berger was able to identify oscillatory activity, such as Berger's wave or the alpha wave (8-13 Hz), by analyzing EEG traces. Berger's first recording device was very rudimentary [1]. He inserted silver wires under the scalps of his patients. These were later replaced by silver foils attached to the patient's head by rubber bandages. Berger connected these sensors to a Lippmann capillary electrometer, with disappointing results. However, more sophisticated measuring devices, such as the Siemens double-coil recording galvanometer, which displayed electric voltages as small as one ten thousandth of a volt, led to success. Berger analyzed the interrelation of alternations in his EEG wave diagrams with brain diseases. EEGs permitted completely new possibilities for the research of human brain activities [2].

Although the term had not yet been coined, one of the earliest examples of a working brain-machine interface was the piece Music for Solo Performer (1965) by the American composer Alvin Lucier. The piece makes use of EEG and analog signal processing hardware (filters, amplifiers, and a mixing board) to stimulate acoustic percussion instruments. To perform the piece one must produce alpha waves and thereby "play" the various percussion instruments via loudspeakers which are placed near or directly on the instruments themselves [3]. After his early contributions, Vidal was not active in BCI research, nor BCI events such as conferences, for many years. In 2011, however, he gave a lecture in Graz, Austria, supported by the Future BNCI paper, presenting the first BCI, which earned a standing ovation. Vidal was joined by his wife, Laryce Vidal, who previously worked with him at UCLA on his first BCI paper. In 1988, a report was given on non-invasive EEG control of a physical object, a robot [4]. The experiment described was EEG control of multiple start-stop-restart of the robot movement, along an arbitrary trajectory defined by a line drawn on a floor. The line-following behavior was the default robot behavior, utilizing autonomous intelligence and autonomous source of energy. In 1990, a report was given on a bidirectional adaptive BCI controlling computer buzzer by an anticipatory brain potential, the Contingent Negative Variation (CNV) potential [5]. The experiment describes how expectation states of the brain, manifested by CNV, controls in a feedback loop the S2 buzzer in the S1-S2-CNV paradigm. The obtained cognitive wave representing the expectation learning in the brain is named Electro Expect program (EXG).

## 2. DISCUSSION

According to the author, modular robots need networking for coordination, and it is particularly true for MEMS (Micro electro mechanical system) micro robots. A promising communication technology is nano wireless networking which could be integrated directly into MEMS micro robots-in our case, the catoms of the Claytronics project. We have designed Vouivre, a wireless simulator integrated in Dynamic Physical Rendering Simulator (DPRSim), a modular robot simulator. Using Vouivre and DPR Sim, we have developed new applications for MEMS modular robots. This paper describes DPR Sim This altogether shows the interest of using wireless communications in modular robots. This report presents on a method to evaluate ground slippery condition using a MEMS slip sensor. The sensor discriminated between ground slippery and non-slippery conditions during walking motions of a bipedal robot, which enables the robot to prevent a slip. First, we evaluated the responses of the sensor pressed against an oiled or non-oiled surface.

Then, we proposed a discriminating method between the oiled and non-oiled surfaces using the sensor. Finally, we demonstrated that a bipedal robot was able to evaluate the slippery condition of the ground where the foot of the robot landed during walk. The ability to feel the world through the tools we hold is Haptic Touch. The sensory element that will transform information into experience by remotely interacting with things is challenging. This paper deals with design and implementation of fore finger direction based robot for physically challenged people. The design of the system includes microcontroller, MEMS sensor and RF technology. The robot system receives the command from the MEMS sensor which is placed on the fore finger at the transmitter section. Robot will follow the direction in which we show our Forefinger. The path way of the robot may be either point-to-point or continuous. This sensor can be able to detect the direction of Forefinger and the output is transmitted via RF transmitter. In the receiver section RF receiver which receives corresponding signal will command microcontroller to move robot in that particular direction. Therefore the simple control mechanism of the robot is shown. Experimental results for fore finger based directional robot are enumerated.
A capacitive micro electro mechanical systems (MEMS) accelerometer was developed to improve the dynamic balancing capability of the bipedal robot developed by Robotics and Automation Laboratory (RAL) of the University of the Philippines Diliman. Experiments were conducted to validate the actual behavior of the accelerometer prior to utilization in the main robot system by the characterization of the mechanical resonance frequency using electrostatic actuation and series of impedance (admittance) measurements. The calculated mechanical resonance frequency showed excellent agreement with both the theoretical and simulated values, showing only 4% and 7% deviation, respectively. Such accuracy serves to highlight the applicability of the MEMS accelerometer in obtaining precise and reliable performance for this intended application.
We present a new approach for mobile robot heading detection using MEMS Gyro north finding method. Based on this, the robot heading angle measurement scheme is proposed; improved north finding theory and algorithm are also explained. Several approaches are applied to confirm system's precision and effectiveness. In order to find out the heading angle, we use a single axis MEMS gyroscope and accelerometer package to sense the angle between the robot heading direction and the north. At the same time, we apply the accelerometer to sense the effect of the earth gravity to ensure the targeting function on both horizontal road and rugged road. To reach enough estimation accuracy and reduce detection time, we apply Least Square Method (LSM) and Extended Kalman Filter (EKF) for the signal fitting, filtering and data fusion. Through a turn-table, we setup a carouse ling system to decrease the substantial bias effect on gyroscope's heading angle. For the evaluation of the proposed method, this system is implemented to the Pioneer robot platform. The performance and heading error are analyzed after the test.

## 3. EXISTING SYSTEM

- It is a novel vision system for prosthetic peoples.
- It integrates upper-body detection, face detection, eye detection, eye openness estimation, fusion, and symptom measure estimation.

***DISADVANTAGES***

- In Existing of wired interface to robot.
- It is not a automatically control

## 4. PROPOSED SYSTEM

The proposed were conducted with and without hearing and visual noise to find out the noise influence in the signal. The brain-computer is used to monitor the brain waves of the human and drive the robot as per the thought of the user.

***ADVANTAGES***

- Enhanced reliability.
- Reduction in noise.
- Longer lifespan.
- High dynamic response.
- High efficiency.
- The advantage of this solution is that the EEG pulse located on the user's head and the user can wirelessly control the robot.

## 5. MECHANISM

The experiment was conducted with and without hearing and visual noise to find out the noise influence in the signal. The brain-computer is used to monitor the brain waves of the human and drive the robot as per the thought of the user by using the Brain Control Interface (BCI). The advantage of this solution is that the EEG (electroencephalogram) pulse located on the user's head and the user can wirelessly control the robot. The data read by the EEG sensors are transmitted to the robot section using the Bluetooth transmitter Tx. The Bluetooth value receives Rx the signal and drives the robotic hand accordingly.

***BLOCK DIAGRAM***

***BRAIN-SECTION***

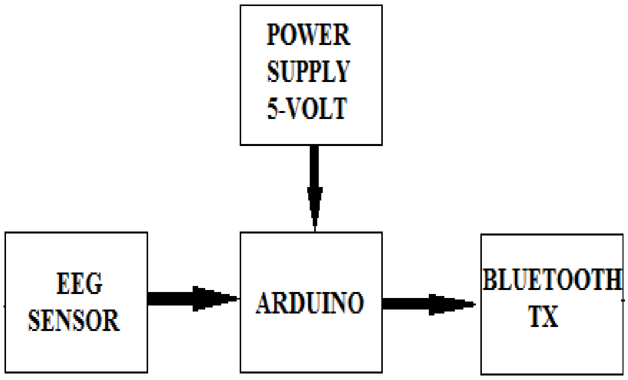


Fig.1 Proposed System Block Diagram for Transmitter Section

***ROBOT HAND-SECTION***

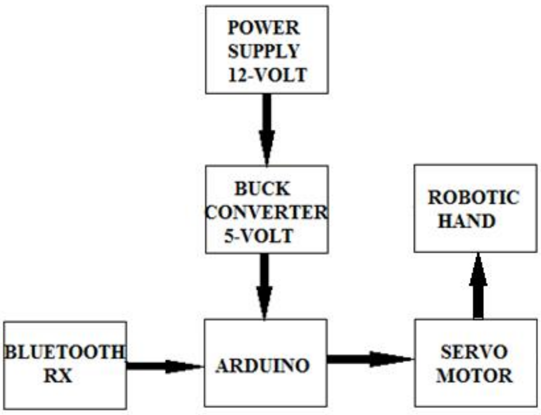


Fig.2 Proposed System Block Diagram for Receiver Section

***HARDWARE SNAPSHOT***

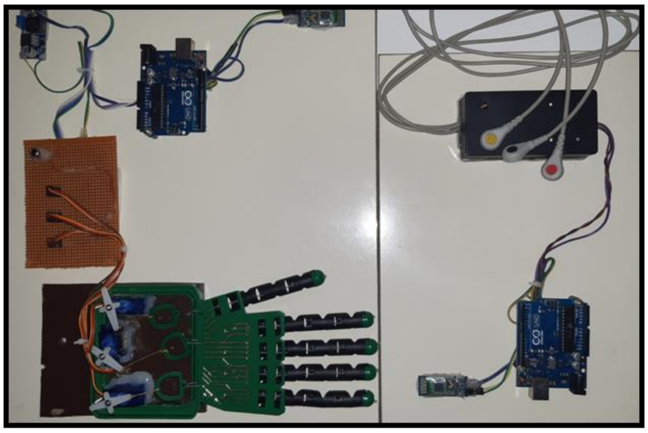

Fig.3 Hardware Design of Proposed System

## 6. CONCLUSION

The objective of this brain-controlled based robot was implementation is to and incorporates mobility to patients suffering from debilitating degenerative muscular diseases. This paper proposes and implements a holistic methodology to acquire EEG signal with simple electrode, hardware implementation of robot efficient EEG feature extractions scheme to derive driving signal. The proposed scheme maneuvering ability can be improved to navigate in uneven and obstacle ridden.

## 7. REFERENCES

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