**Graduation Project Proposal**

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| **Project Information** | | |
| **Project Title** | **Department/Faculty/University** | **Project Field/Discipline** |
| NeuroPhone: Real-Time Brain-Mobile phone interface | Scientific Computing/ Faculty of Computer and Information Science/ Ain Shams University | AI/ ML/ DL/ Computational Neuroscience |
| **Advisors’ Names** | **Advisors’ Mobile Numbers** | **Advisors’ Email Addresses** |
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| **Students’ Names** | **Students’ Mobile Numbers** | **Students’ Email Addresses** |
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**Is this project part of a mega-project at the same institution? 🞎Yes 🞎No (**If yes, please submit all proposals together.)



**If the project is sponsored by or initiated by an ICT company, please state its name**:

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| **Motivation** | | | | | | |
| **Please write why you chose this project idea, explaining clearly the problem that the project is addressing** | | | | | | |
| The main objective of the project is to provide a practical, accessible, and portable solution to help people with motor disabilities and make their daily life activities smoother and easier. According to the World Health Organization (WHO), there are more than 1 billion people living with a disability. This corresponds to about 15% of the world's population. People with motor disabilities need constant help, and they would be in great danger if they are left alone. Even with the existence of smartphones, they are unable to call for help.  That is why we aim to build our project which allows the user to directly connect and use mobile phone applications using only their visual attention. When the user wears the brain-signal-capturing headset and opens their smartphone application, they can easily control their phone, call others and use many other options using only their brain signal that's captured by the headset. | | | | | | |
| **Why do you think your project should be funded? for which the applicants write in a few lines where the help statement should be “Explain in no more than 3 lines the new and innovative aspects in your project that make it worthy of funding.”** | | | | | | |
| This project is a composite of 2 approaches that align together to produce a unique novel solution. The first approach is focused on building a hardware circuit (brain-signal-capturing headset) that would be both affordable and portable to make it accessible to people who need it but couldn't afford its expensive equivalent. The other approach is focused on providing an AI-based software application that's both accurate and has a high communication speed to ensure the quality of signal transmission and overall solution. | | | | | | |
| **Block Diagram** | | | | | | |
| **Please insert the project detailed block diagram below, (Please highlight the parts that will be implemented in different colors than the parts that will be purchased)** | | | | | | |
| **-**  **Diagram  Description automatically generated** | | | | | | |
| **Prototype Description and Specifications** | | | | | | |
| **Please note that ITAC only funds projects that result in a prototype. Include a clear description of how the prototype will operate, explaining a scenario/use case of the operation. Also include the performance metrics you target in the prototype.** | | | | | | |
| The prototype operates as follows:  1. The user wears the brain-signal-capturing headset and opens the mobile phone application that's specifically developed to receive the user's brain signal.  2. The application displays a set of choices that represent specific functionalities for the user to choose from.  3. The user is expected to visually focus on one choice (functionality) that they desire.  4. The headset is reading the user's brain signal and sends it to the mobile application.  5. Mobile application then receives that signal, interprets it, and then carries out the intended functionality that maps to the user's choice.  Below is a video of a similar scenario:  <https://www.youtube.com/watch?v=XIr2cRKFolY&t=178s>  The performance metrics of our solution are:  1. Classification accuracy of correct user choices.  2. Communication speed between the headset and mobile phone application. | | | | | | |
| **Project Plan** | | | | | | |
| **Please define the approach and phases to deliver the intended project outcome.** | | | | | | |
| **The work approach was divided into two branches in two parallel directions:**   1. Work on building a device dedicated to capturing brain signals.   The device should pick up the signals and send them to the mobile phone with reasonable accuracy and speed.   1. Work on building a mobile application that employs deep learning techniques in its work base.   To receive brain signals and achieve a high accuracy rate in analyzing, processing, and translating them into the appropriate service desired by the user.  We periodically synchronize the two branches with each other in order to achieve compatibility between the two activities and to facilitate the process of linking them later.  **phases for the project:**  **For the signal capture device:**   * Design Signal Processing circuit. * Convert this circuit to PCB. * Design headset.   **For the software and mobile app:**   * Prepare the dataset. * Apply some preprocessing on the dataset. * Work on implementation and improve our deep learning models. * Deployment the application and link it with the hardware. | | | | | | |
| **Prototype Prospects** | | | | | | |
| **List the Egyptian ICT companies that may be interested in the developed prototype and the end-users/customers (name the specific class of individuals, governmental agencies, ministries … etc. that will benefit from the prototype)** | | | | | | |
| **List of ICT Companies:**   * [**Top Healthcare companies in Egypt**](https://www.glassdoor.com/Explore/top-healthcare-companies-cairo_IS.4,14_ISEC10012_IL.25,30_IM1175.htm) * [**Andersen** **Company**](https://andersenlab.com/)   **Potential End-Users/ Consumers:**  Anyone can use this device but especially for:   * People with disabilities. * Ministry of health. | | | | | | |
| **Project Budget** | | | | | | |
| **Item** | **Type (Hardware/ Software/ Other)** | **Part in the Block Diagram** | **Possible Provider/ Merchant** | **Specifications** | **Quantity** | **Price in EGP** |
| **ADC** | **Hardware** | EEG circuit | Ram Electronics | 32-bit ADC | 3 | 500 |
| **instrumentation Amplifier** | **Hardware** | EEG circuit | Ram Electronics | **AD620AN** | 5 | 150 |
| **Quad Op-Amp -** | **Hardware** | EEG circuit | Ram Electronics | **TL084CN** | 10 | 50 |
| **Capacitors** | **Hardware** | EEG circuit | Ram Electronics | Various values kit | 1 | 90 |
| **Resistors** | **Hardware** | EEG circuit | Ram Electronics | From 10 ohm to 1M ohm kit | 1 | 30 |
| **Ambu Neuroline Cups** | **Hardware** | Electrodes | **Ambu** | 150cm x 10 electrodes | 3 | 250 |
| **electrode gel** | **Hardware** | EEG circuit | **Ambu** | 1020 conductive gel | 1 | 190 |
| **Power supply** | **Hardware** | EEG circuit | Ram Electronics | 9V , 2A power supply | 1 | 150 |
| **PCB** | **Hardware** | EEG circuit | Sector B |  | 5 | 2000 |
| **EMOTIV headset** | **Hardware** | EEG headset | **EMOTIV** | **EPOC X 14 Channel Mobile Brainwear** | 1 | 25000 |
| **Grand Total** | | | | | | 30.789 |