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PROJECT SYNOPSIS [46S_BE_1250]

1)	**Title of the project**	EYE TRACKING SYSTEM FOR APPLIANCE CONTROL BY PARALYZED PATIENTS
2)	**Name of the college and** **Department**	K. S. School of Engineering and Management, Department of Electronics and Communication Engineering
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5)	**Keywords**	Eye Tracking, Iris Tracking, Assistance System, Python, OpenCV, Raspberry Pi, Appliance Control
6)	**Introduction**	Patients with debilitating conditions like Motor Neuron Disease, Paraplegia, Quadriplegia, Parkinson's Disease, Locked-In Syndrome, etc, face severe issues communicating with others, as well as navigating the world and interacting with devices. Such patients need round-the-clock care, and such human caretakers can lead to huge medical expenses, and end up using up a lot of manpower. In order to reduce the patient's reliability on human assistance, research has been done to design semi-autonomous or autonomous assistance systems, which enable the patients with severe limitations in mobility, to interact with other people, or with their environment, to perform simple control task. This project is aimed at designing a wearable system which can help people with paralysis, paraplegia or locked in syndrome, to control external appliances like lights, fans, etc., through the use of an eye-tracking interface.

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<td>Objectives</td>
<td>This project is aimed at designing a wearable system which can help people with paralysis, paraplegia or locked in syndrome, control external appliances like lights, fans, etc., through the use of an eye-tracking interface.
The System involves the use of a low-cost microprocessor like the Raspberry Pi Zero, with an attached camera, with open-source software platforms like Python and OpenCV library, running on Linux operating System.
By using non-proprietary open-source software, and on low-cost processors, we will be able to make an affordable assistance system, which can track the user’s iris, and use this to control the cursor on a display device, enabling the use of the system to automatically control household appliances like lights and fans.
This system is intended to provide some degree of independence and autonomous control to the patients, who would need extensive human assistance otherwise.</td>
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<td>Methodology</td>
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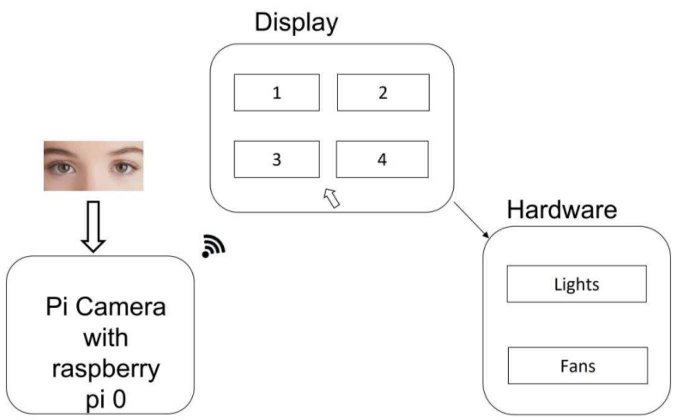

Fig 1. Block Diagram of System

The project aims at designing and implementing a Raspberry Pi-based eye-tracking and eyeblink detection system, which will enable the disabled person to control a cursor on a computer interface, allowing them to manually control appliances, without the need of a manual control device like a mouse or buttons

The system mainly consists of two blocks – the Pupil Tracking system and the Display and Appliance Control System as shown in Figure.

The Eye Tracking System consists of a compact and lightweight Raspberry Pi Zero microprocessor, with a Raspberry Pi camera connected to it. This unit is mounted onto wearable glasses, and is designed to capture the image of the wearer’s eye.

Computer Vision algorithms are implemented using Python+OpenCV on the Raspberry Pi Zero, and this algorithm detects the pupil and tracks its position relative to the eye. The algorithm is also designed to detect eyeblinks. The coordinates of the pupil are mapped to the display device’s resolution, and the data</td>
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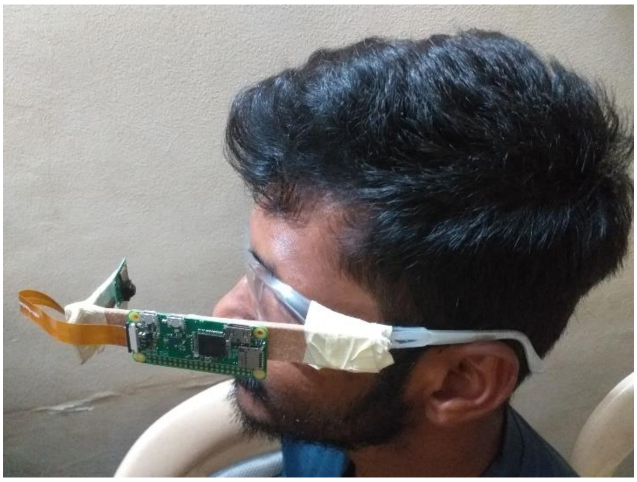
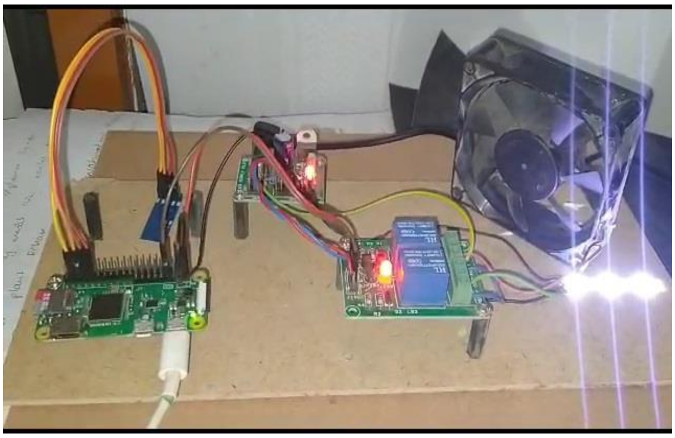
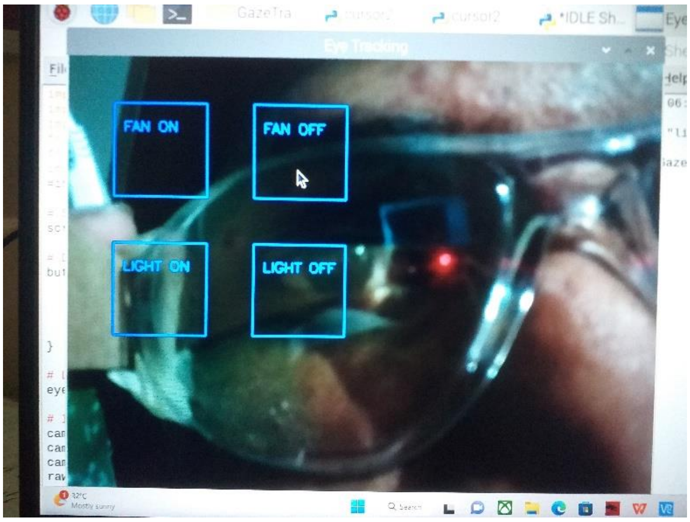
		is sent to the Display and Appliance Control System, via Zigbee. The Second Raspberry Pi receives the pupil tracking data from the Eye tracking system, and it is used to move the cursor, based on the eye movement. Based on eye movement and blinks, preprogrammed GUI buttons on the display are clicked, and the corresponding appliances (fans, lights, etc) which are connected to the Raspberry Pi are turned on or off. A predetermined sequence of eyeblinks is used to initiate and end the eye tracking and localization process. A sequence of 3 rapid eyeblinks initializes the system. Two rapid blinks are mapped to the mouse click operation. Once the user is done using the system, another sequence of 3 rapid eyeblinks ends the eye tracking system. The sequence of multiple blinks is used to differentiate between intentional blinks and automatic involuntary blinking.
9)	**Results and conclusion**	 *Fig 2. Iris Tracking System*  *Fig 3. Receiver System Showing Appliance Control* During the course of this project, we have successfully developed an eye-tracking system using a Raspberry Pi and PiCamera. By detecting eye movements and mapping them to screen coordinates, cursor control and button interaction have been achieved. The system implemented EAR-based blink detection, accurately identifying blinks for

		enabling/disabling control mode. Integration of a Zigbee module enabled signal transmission to a receiver module, allowing control of external devices. Overall, the system demonstrated the potential for hands-free control through eye movements, providing a convenient and efficient user experience.  *Fig 4. Display Interface*
10)	**Scope for future work** .	Further research can be conducted to improve the accuracy and reliability of blink detection algorithms by incorporating advanced computer vision techniques and machine learning models. The system performance can also be improved using faster microprocessors which are capable of offering real-time results, which would enable extended functionality in the device. The system can be designed further to improve the robustness to handle various environmental factors, such as different lighting conditions, head movements, and wearing glasses, for more reliable and seamless eye-tracking performance