International Journal For Advanced Research In Science & Technology
A peer reviewed international journal
www.ijarst.in
ISSN: 2457-0362

Wheelchair control through eye blinking and IoT platform

[1] Mr. VENKATESHWARLU CHETTI,[2] D. Eshwari chan,[3] D.Bhakti patel,[4] C .VAISHNAVI

[1]Assistant Professor, Department of ECE, Mallareddy Engineering College for Women, Hyderabad

[2,3,4]Students, Department of ECE,Mallareddy Engineering College for Women, Hyderabad

ABSTRACT

Decision-making considering commands coming from eye blinking, to give mobility to a wheelchair, is not a simple task, bad decisions can end up in moving a person in a wrong direction, which will give more difficulties instead of solutions. In the actual study a microcontroller with embedded software and hardware for IoT is used, this device can manage multiple sensors as inputs and multiple actuators as outputs. The raspberry Pi 3 was selected because it is single-board computer with wireless LAN and Bluetooth Low Energy (BLE) on board. The developed system discriminates an involuntary blinking from a low motion voluntary blinking and take a decision to move forward a model wheelchair. The position and given commands are sent to an IoT platform to save the wheelchair movement data.

I.INTRODUCTION

In May 2019, the National Institute of Statistics and Censuses (INEC, for its acronym in spanish) and the National Council of People with Disabilities (Conapdis, acronym in spanish), presented the general results of the first National Survey on Disability 2018 (Enadis). This research is a project that is part of the Costa Rican System Information on Disability (Sicid), which is the official platform of coordination, institutional linkage and sectorial articulation of the Costa Rican government to facilitate the management and distribution of knowledge and national information on disability, as well as the rights of People with disabilities [1]. As first step of this research, some terms related to people with disabilities have to be defined:

1) Disability (general definition): as part of the understanding of disability and evolution of the concept, the transition from the traditional model is identified biomedical, up to a model consistent with the rights approach human, that recognizes disability as the result of the interaction of a person with a health

condition and environmental barriers, and that these barriers translate into restrictions on the participation of these people with equal opportunity than others.

2) People with disabilities (specific definition): are those people who present restriction on their participation as a product of the interaction between their health condition (disease, disorder or deficiency) and barriers contextual, attitudinal and environmental.

3) People without disabilities: they are those who do not see each other restricted in their participation, that is, without disability. Does not mean that these people do not experience difficulties in their operation or They are not at risk of being in a situation of disability.

4) Degrees of disability: is the division of people in situations of disability according to grades: mild to moderate and severe, which They respond to the difficulty of daily activities.

II.METHODOLOGY

A) System Architecture

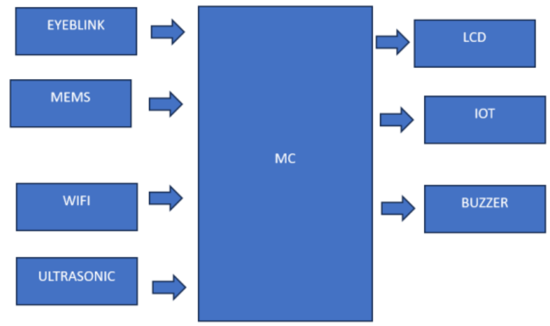

Fig1 .Block Diagram

The system architecture for smart monitoring of wheelchair control through eye blinking and an IoT platform involves integrating eye-tracking sensors or EEG sensors to detect eye movements or blinks, which are processed to control the wheelchair's movements. These sensors send the data to a microcontroller or embedded system, which interprets the eye signals and translates them into specific wheelchair commands, such as moving forward, turning, or stopping. The data is transmitted to an IoT platform for real-time monitoring, allowing caregivers or medical personnel to track the wheelchair's position and the user's condition. Additionally, the system can incorporate voice commands or gesture recognition for enhanced control.

B) Proposed Raspberry pi

The Raspberry Pi Pico is an affordable microcontroller board created by the Raspberry Pi Foundation. Unlike full-fledged computers, microcontrollers are small and have limited storage and peripheral options, such as the absence of devices like monitors or keyboards. However, the Raspberry Pi Pico is equipped with General Purpose Input/Output (GPIO) pins, similar to the ones found on Raspberry Pi computers, allowing it to connect with and control a variety of electronic devices. Introduced in January 2021, the Raspberry Pi Pico is based on the RP2040 System on Chip (SoC), which is both cost-effective and highly efficient. The RP2040 SoC includes a dual-core ARM Cortex-M0+ processor that is well-known for its low power consumption. The Raspberry Pi Pico is compact, versatile, and performs efficiently, with the RP2040 chip as its core. It can be programmed using either Micro Python or C, providing a flexible platform for users of various experience levels. The board contains several important components, including the RP2040 microcontroller, debugging pins, flash memory, a boot selection button, a programmable LED, a USB port, and a power pin. The RP2040 microcontroller, custom-built by the Raspberry Pi Foundation, is a powerful and affordable processor. It features a dual-core ARM Cortex-M0+ processor running at 133 MHz, 264 KB of internal RAM, and supports up to 16 MB of flash memory. The microcontroller provides a wide range of input/output options, such as I2C, SPI, and GPIO. The Raspberry Pi Pico has 40 pins, including ground (GND) and power (Vcc) pins. These pins are grouped into categories such as Power, Ground, UART, GPIO, PWM, ADC, SPI, I2C, System Control, and Debugging. Unlike the Raspberry Pi computers, the GPIO pins on the Pico can serve multiple functions. For instance, the GP4 and GP5 pins can be set up for digital input/output, or as I2C1 (SDA and SCK) or UART1 (Rx and Tx), though only one function can be used at a time.

C) Design Process

The design of embedded systems follows a methodical, data-driven process that requires precise planning and execution. One of the core elements of this approach is the clear separation between functionality and architecture, which is crucial for moving from the initial concept to the final implementation. In recent years, hardware-software (HW/SW) co-design has gained significant attention, becoming a prominent focus in both academia and industry. This methodology aims to align the development of software and hardware components, addressing the integration challenges that have historically affected the electronics field. For large-scale embedded systems, it is essential to account for concurrency at all

International Journal For Advanced Research In Science & Technology
A peer reviewed international journal www.ijarst.in
ISSN: 2457-0362

levels of abstraction, impacting both hardware and software components. To facilitate this, formal models and transformations are employed throughout the design cycle, ensuring efficient verification and synthesis. Simulation tools are vital for exploring design alternatives and confirming the functional and timing behavior of the system. Hardware can be simulated at different stages, including the electrical circuit, logic gate, or RTL level, often using languages like VHDL. In certain setups, software development tools are integrated with hardware simulators, while in other cases, software runs on the simulated hardware. This method is generally more suited for smaller parts of an embedded system. A practical example of this methodology is the design process using Intel's 80C188EB chip. To reduce complexity and manage the design more effectively, the process is typically divided into four main phases: specification, system synthesis, implementation synthesis, and performance evaluation of the prototype.

APPLICATIONS

Embedded systems are being increasingly incorporated into a wide range of consumer products, such as robotic toys, electronic pets, smart vehicles, and connected home appliances. Leading toy manufacturers have introduced interactive toys designed to create lasting relationships with users, like "Furby" and "AIBO." Furbies mimic a human-like life cycle, starting as babies and growing into adults. "AIBO," which stands for Artificial Intelligence Robot, is an advanced robotic dog with a variety of sophisticated features. In the automotive sector, embedded systems, commonly referred to as telematics systems, are integrated into vehicles to offer services like navigation, security, communication, and entertainment, typically powered by GPS and satellite technology.

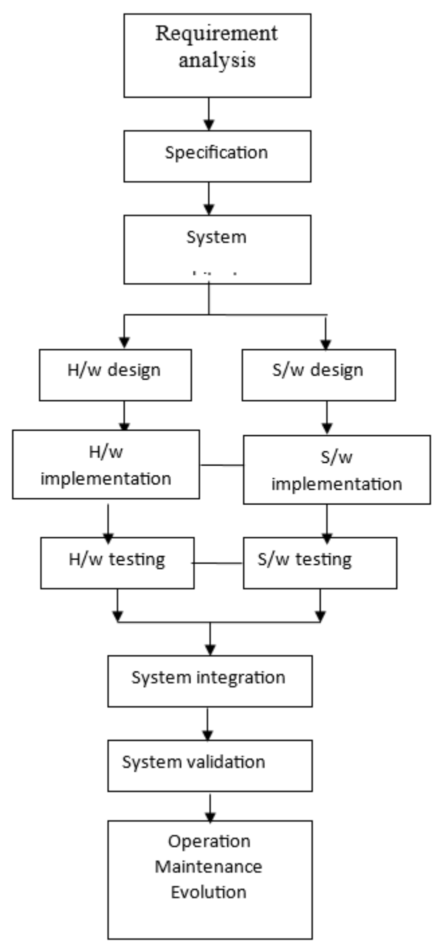

Fig 2. Embedded Development Life Cycle

The use of embedded systems is also expanding in home appliances. For example, LG's DIOS refrigerator allows users to browse the internet, check emails, make video calls, and watch TV. IBM is also developing an air conditioner that can be controlled remotely via the internet. Given the widespread adoption of embedded systems across various industries.

III.CONCLUSION

A functional prototype of a system to detect slow voluntary blinking was analyzed and tested. It was possible to obtain a reliability of 100 % in the measurements of the position and movement of a simulated wheelchair. The communication between the Raspberry and the IoT was successful and the IoT ThingSpeak platform worked following all given specifications.

IV.FUTURE SCOPE

The future scope includes enhancing eye-tracking accuracy and responsiveness, allowing for smoother control in different lighting conditions and with various user states. Integration with 5G would enable real-time data transmission, allowing for seamless control and monitoring over larger distances. The system could also incorporate AI-based learning algorithms to adapt to the user's specific patterns of eye movements, improving the system's responsiveness and comfort. Furthermore, smart healthcare features, like vital sign monitoring and environmental adjustments, could be integrated into the IoT platform for comprehensive health and mobility support.

V.REFERENCES

[1] I.-I. N. de Estad´ıstica y Censo, "Encuesta nacional sobre discapacidad 2018," May 2019. [Online]. Available: https://http://inec.cr/sites/default/files/documetos-bibliotecavirtual/reenadis2018.pdf

[2] S. Shinde, S. Kumar, and P. Johri, "A review: Eye tracking interface with embedded system iot," in 2018 International Conference on Computing, Power and Communication Technologies (GUCON), Sep. 2018, pp. 791– 795.

[3] U. Garg, K. K. Ghanshala, R. C. Joshi, and R. Chauhan, "Design and implementation of smart wheelchair for quadriplegia patients using iot," in 2018 First International Conference on Secure Cyber

Computing and Communication (ICSCCC), Dec 2018, pp. 106–110.

[4] A. Carrasquilla-Batista, K. Quiros-Espinoza, and C. G ´ omez-Carrasquilla, ´ "An internet of things (iot) application to control a wheelchair through eeg signal processing," in 2017 International Symposium on Wearable Robotics and Rehabilitation (WeRob), Nov 2017, pp. 1–1.

[5] S. Khandani, "Engineering design process, education transfer plan," 2005. [Online].Available: https://www.dphu.org/uploads/attachements/books/books25470.pdf

[6] M. Varela, "Raw eeg signal processing for bci control based on voluntary eye blinks," in 2015 IEEE Thirty Fifth Central American and Panama Convention (CONCAPAN XXXV), Nov 2015, pp. 1–6.

[7] ADC0808/ADC0809 8-Bit µP Compatible A/D Converters with 8-Channel Multiplexer Texas Instrumentation

[8] P89V51RB2/RC2/RD2 8-bit 80C51 5 V low power 16/32/64 kB flash microcontroller with 1 kB RAM Rev. 05 — 12 November 2009 Product data sheet

[9] The 8051 Microcontroller and Embedded Systems using Assembly and C – Second Edition Muhammad Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay

[10]http://www.engineersgarage.com/electroniccomponents/ rf-module-transmitter-receiver

[11]https://www.sparkfun.com/datasheets/Comp onents/ ADXL330_0.pdf

[12]https://learn.sparkfun.com/tutorials/accelero meter-basics/all