INTERACTIVE SCREENS

Project Reference Number: *47S_BE_0095*

College ***:*** *Dayananda Sagar Academy of Technology and Management*
Branch ***:*** *Department of Computer Science and Engineering*
Guide(s) ***:*** *Dr. Kavitha C and Dr. Shalini S*
Student(S) ***:*** *Ms. Manisha Poonia*
Mr. Mansoor Ahmed
Ms. Meghana M
Mr. Naveed N

Keywords:

OpenCV, Arduino UNO, Digital Camera, Human-Computer interaction, pyautogui, Bluetooth, Laser, Mediapipe

Introduction:

Traditional systems for short-distance interaction with PowerPoint presentations often involve the use of remote controls or clickers. These devices are designed to enable presenters to navigate through slides and control the flow of a presentation without being tethered to a computer. However, they typically do not provide interaction with browsing or search options and other system applications. These are limited to close proximity and PowerPoint Presentation of moving forward and backward and does not control the all the available options.

Some of the Existing systems for long-distance interaction between humans and computers are Remote desktop software allows users to control a computer from a remote location over a network, but it can be limited by network latency. Gesture recognition systems use cameras or sensors to track and interpret gestures, providing natural interaction but may struggle with complex gestures. Touchless interfaces use technologies like infrared sensors to detect movement, offering a hygienic experience but requiring precise calibration. Voice control systems enable hands-free interaction, ideal for multitasking, but can be limited by background noise.

The proposed Laser-Controlled system offers a revolutionary approach, utilizing a laser-emitting mouse and fingertip recognition for precise and intuitive interaction. This system enables users to control screen elements from a distance, providing flexibility and natural interaction. By detecting the laser and fingertip coordinates on the screen, OpenCV allows the laser to function as a cursor, triggering actions based on screen coordinates. Arduino's components, including the Bluetooth Module HC-05 and Joystick Module, wirelessly communicate with the computer to execute keyboard and mouse inputs. This innovative approach transcends physical touch and proximity.

Objectives:

1. Develop a system for long-distance computer interaction
2. Implement fingertip detection.
3. Integrate a laser pointer for precise interaction
4. Utilize Arduino microcontroller for hardware interfacing
5. Ensure seamless communication using Bluetooth technology
6. Switching Between Hand and Laser Detection

Methodology:

Materials- Arduino UNO, Push Buttons, Joystick Module, Breadboard, Bluetooth Module, wires

Methods- Pyautogui, OpenCV, Mediapipe, Pynput

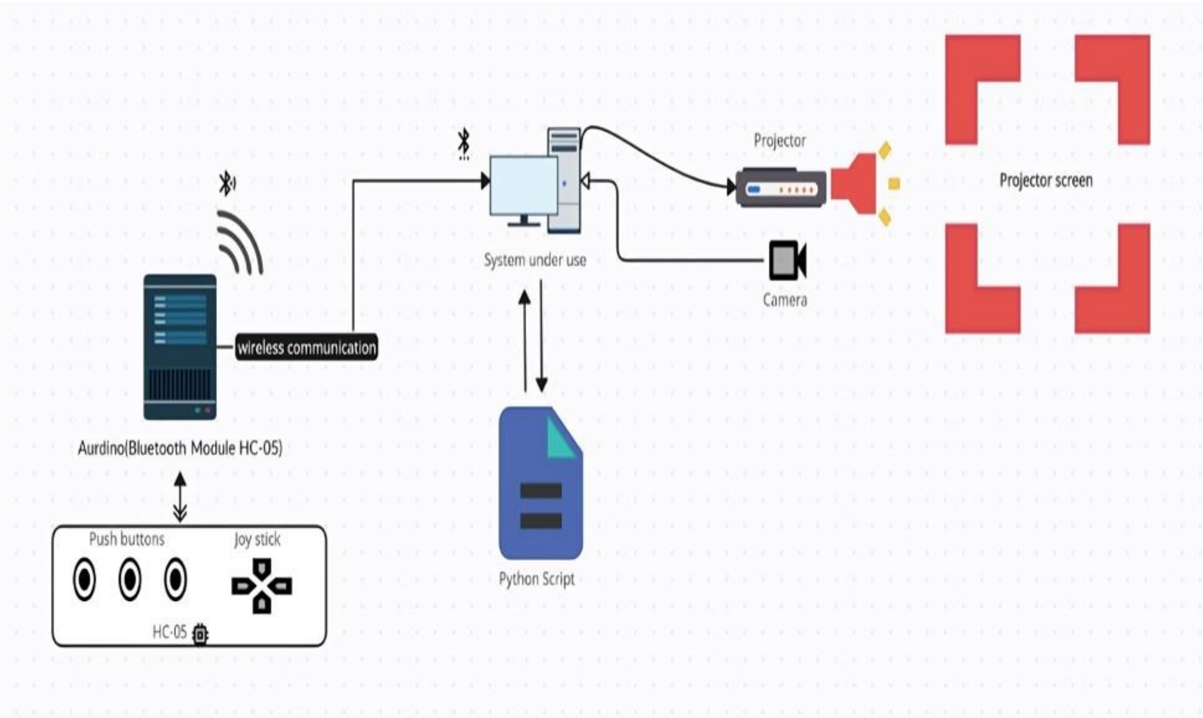

Fig 1: System Architecture

The methodology for this project begins with the setup of the hardware components, including the Arduino UNO, Bluetooth modules, buttons, and joystick module, which are interconnected and configured to function harmoniously. Subsequently, the software environment is established, utilizing the Pycharm and relevant libraries to program the logic for mouse emulation. This encompasses interpreting button presses for cursor movement and implementing scrolling functionality. The HC-05 Bluetooth module facilitates wireless communication between the Arduino and the computer, transmitting formatted data packets that convey mouse movements and keyboard actions. The process involves acquiring data from the hardware, formatting it for transmission, and sending it to the computer, where it is interpreted as user input.

The Python script for Bluetooth-connected joysticks to control a computer mouse begins by setting up variables and establishing a serial connection with the controller. The script defines variables for joystick sensitivity and button press threshold. It then enters a main loop where it continuously monitors joystick input and button presses. Joystick data is retrieved and parsed, and the script moves the mouse cursor in response to changes in joystick position. Button presses are also handled, with examples provided for keystroke emulation for buttons b1 to b3. The script can be expanded to accommodate additional button actions.

On the other hand, the algorithm for hand detection or color-based laser tracking to manipulate the mouse cursor involves importing required libraries and initializing variables for color tracking. It then enters a loop to capture webcam frames, resize them, and display them in a window. Depending on the tracking mode (hand or laser), the algorithm detects hand landmarks using MediaPipe or isolates pixels containing the designated color. It then adjusts the mouse cursor position accordingly. Users can switch between tracking modes and terminate the program by pressing keys. Overall, this code provides a framework for controlling the mouse cursor using hand gestures or a laser pointer.

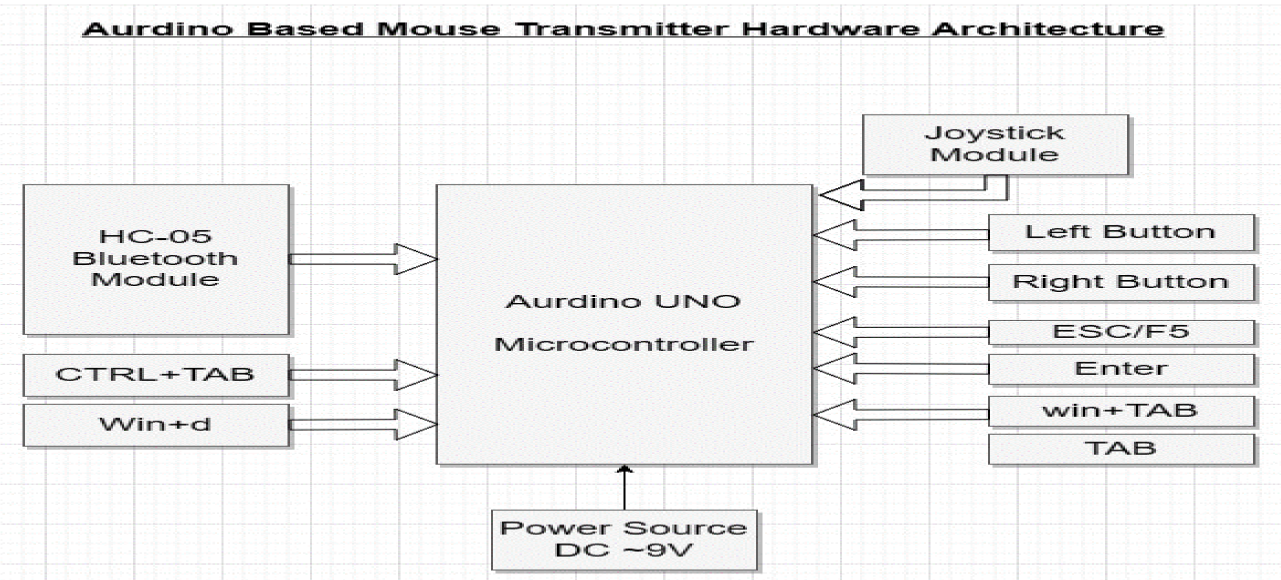

Fig 2: Arduino Based Mouse Transmitter Hardware Architecture

Conclusion and Result:

The development of the Laser-Controlled system has been accomplished with success, and it exhibits encouraging outcomes with regard to precision, dependability, and usability.

1. Accurate Hand Gesture Recognition: The system achieves a high level of accuracy of 86% in detecting and tracking hand gestures, enabling precise control of the computer's cursor with a minimal latency of 30-50ms.

2. Efficient Laser Pointer Interaction: The system effectively simulates mouse clicks on the computer screen using a laser pointer, providing an alternative input method with minimal latency of 120-170ms.

3. Seamless Mode Switching: Users can seamlessly switch between hand gesture control and laser pointer interaction modes, enhancing the user experience.

4. Performance: The system exhibits commendable performance, characterized by a negligible delay between user input and the corresponding on-screen response.

In Conclusion, the project has effectively accomplished its goals of developing a human-computer interaction system that enables individuals to operate a computer by utilising a laser pointer and hand gestures. The system is a valuable instrument for augmenting user-computer interaction due to its precise hand gesture recognition, effective laser pointer interaction, smooth mode switching, dependable performance, and user-friendly interface.

Future Scope:

1. Enhanced Gesture Recognition
2. Improved Color Tracking
3. User Interface Enhancements
4. Multi-User Support
5. Accessibility Features
6. Integration with Other Devices
7. Performance Optimization
8.Voice-Control Integration
9.Gesture Customization
10.Security Enhancements
11.Application-Specific modes
12.Educational Use for Presentations
13.Integration with other Devices
14.Hardware Optimization
15.Commercialization