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PI TOP: HARDWARE MADE SIMPLE

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Abstract : According to our most recent research, teachers who are skilled in the use of digital tools can facilitate the development of higher-order thinking skills, provide them with distinctive and imaginative ways to articulate what they have studied, and best prepare them to deal with continuing changes in technology in both the physical world and the job. To support this educational revolution, India requires cost-effective and cutting-edge instructive equipment. Technology is an essential component of STEM education. We designed low-cost educational laptop computers for educators, students, and schools. This laptop is easy to use and has good connectivity and computing power. The physical computing function can assist young students improve their programming skills and creativity.

***IndexTerms* - Raspberry Pi, Laptop, Operating Systems, Supercomputer, Affordable, Programming.**

I. INTRODUCTION

Information technology is an ever-evolving field that constantly provides new solutions to the public. Schools use a variety of ICT devices to interact, allocate, create, store, and organize information. Using smartphones and tablets or tablet computers to learn all through lectures, along with the "flipped classroom" model, in which students watch live and recorded lectures at home on a device and use classroom time for more hands - on experiences, are some examples of how ICT has become an essential part of the teaching-learning process. When educators are digitally literate and instructed to use ICT, these techniques can enhance higher-order thinking skills, provide unique and personalized ways for students to express their personalities, and make students equipped to deal with ongoing technological changes in both the world and the workplace.

Devices such as the Raspberry Pi have been frequently used to demonstrate this phenomenon. Because of ongoing miniaturization and low-cost components, engineers were successful in developing a low-cost, hand computer with persuasive technical specifications. These microcomputers are capable of a wide range of tasks, ranging from industrial uses to home entertainment. The Raspberry Pi Foundation set the benchmark even higher by challenging themselves to create a versatile tool to improve the quality of IT instruction.

This project shows how a low-cost project can provide educational institutions with new capabilities, allowing them to provide learners with the chance to learn how to develop while using applications they will encounter in the future. The independent project-based structure of the project proved to be a critical component in its effective design and execution.

The accessibility of inexpensive, high-power single-board computer systems like the Raspberry Pi has made the building of big cluster computers more affordable. This paper describes a low-cost and simple method for providing students with programming knowledge on supercomputers that does not rely on simulation or visualization. A sample prime search programme written to operate on a multi node cluster is provided, along with run-times, to help the reader understand the benefits of programs written to take advantage of parallel computer architectures.

We propose a low-cost laptop for schooling with the distinct potential of physical computing in this paper. This laptop was designed using the Raspberry Pi, a single-board computer. This device supports several programming languages, including C, C++, Python, Java, and Scratch. It provides excellent software for operating office tasks such as spreadsheet creation, word processors, and presentation preparation. It operates on an open-source OS based on Linux and is suitable for both educational as well as non-educational purposes.

II. NEED OF THE STUDY

Because of the current COVID- 19 epidemic, which is affecting the entire world, a new place in the digital world has emerged, while the world continues to practice social distance. System Technology advances in order to address this issue, where almost all of India works from home. Seminary/sodality students are having trouble keeping up with expensive equipment (laptops/desktops). To overcome this obstacle, I came up with the brilliant idea of employing a low-cost bias that could prevent thousands of bucks on a laptop/desktop.

Increasing numbers of learners are searching for possibilities for gaining hands-on understanding with technological advances that interest them personally but may go beyond the scope of the intended curriculum. This paper looks at a single, independent project wherein a student built a supercomputer using the parallel processing capability of ten Raspberry Pi devices. The importance of this study lies in its interpretations of how unbiased activities can be utilized for students to gain outside the education system to increase their academic presence in the field, how to cultivate a thorough learning community for the society and community, provide a path for learners to obtain course credit without having caused financial hardship for the college, and finally this specific goal of building a supercomputer.

Many people have begun to use the 'Raspberry Pi 4 B with Raspberry Pi OS'. This allows them to connect to their online class, browse the internet, communicate office systems to virtual servers, and perform real-time multitasking and productivity.

Physical computing solutions that are inexpensive, quick, easily interpretable, engaging, and long-lasting, in our opinion, can greatly benefit the classroom. The Raspberry Pi is one of many incorporated, masterfully constructed physical computing devices that have the potential to firmly demonstrate physical computing as an essential component of modern computer science education. These board-level embedded devices should sooner or later have increased computational power, improved wireless connectivity, improved physical building kit integration, and increased extensibility. They will also most likely be becoming less pricey and smaller than current offerings, making them even more suitable for a variety of school projects and uses such as wearable technology, automation, and gaming.

Data collection in the environmental and natural sciences is strongly supported by physical computing. As physical computing devices—natural sources of sensor information increasingly important in the rapidly developing field of data science, the next formation of scientists will be engaged and educated. Ultimately, both students and novices can be provided with the tools necessary to begin a producer path in a variety of domains of application.

However, there are still numerous challenges. Teachers and technology programmers must collaborate closely to create a compelling end-to-end experience for both learners and educators. End-to-end experience is dependent on tight software and hardware environment integration. Of course, high-quality coursework, training, and teacher preparation are also required.

III. RESEARCH METHODOLOGY

According to a government survey carried out by the Department of School Education & Literacy and the National University of Educational Planning and Administration, only 26.42% of Indian schools have computers (NIEPA). The report included 1.52 million schools in India's 36 states and union territories for the academic year 2014-15. Secondary school students urgently require an affordable educational laptop to learn basic programming and physical computing. This device will make it simple for students in schools to learn coding and physical computing.

The abundant supply of quality educational apps and websites available is unquestionably a benefit of computers' widespread use. Learning can take the form of fun and educational games, movies, and lessons that help students enhance their comprehension of subjects ranging from vocabulary to mathematics, typing to logical reasoning, and everything in between. The Indian government established Atal Tinkering Labs (ATLs) in a variety of places to provide cutting-edge facilities to makers and innovators. This ATL's requirement for large quantities of physical computing devices and computers can be met with a low-cost, simple device.

Physical computers with processing power are extremely rare. Pi-Top, ExpEYES (formerly as Phoenix), and BBC micro:bit are three similar products currently on the market. The BBC micro:bit is a programmable computer with Bluetooth, motion detection, and an integrated compass. The Micro:bit can be connected to other devices or sensors thanks to its in-built compass or "magnetometer," 25 LEDs, two programmable buttons, and five input/output ports. BBC distributed approximately 1 million devices to students in the United Kingdom between the ages of 11 and 12. Because the BBC Micro:bit does not have a display; programming must be done on a computer or laptop. ExpEYES is a low-cost platform for computer-assisted lab experiments. The Inter-University Accelerator Center in New Delhi created it.

It has 50 experiment GUIs, as well as 12 bit analogue and electronic input/output, time interval metrics, frequency production, and testing equipment functionality. The best aspect of this device is that the hardware is open source; however, programming it requires a computer or laptop. Finally, it serves as a low-cost framework for scientific experiments. The Pi-top, a modular laptop, serves as a resource for creating innovative do-it-yourself (DIY) projects and helping to bring inventions to life. A Raspberry Pi computer serves as the system's brain. Four USB ports, 40 GPIO pins, an HDMI port, Gigabit Ethernet port, wireless LAN (Wi-Fi), and a display interface are all included in the package, as is a quad-core Arm cortex processor running at 1.4GHz. This device costs approximately 27000 INR, which is nearly identical and a high price.

This is a low-cost laptop for students to use for education, tinkering, and performing research whenever and anywhere they want to. They can avoid lab hours and, in certain cases, avoid the problem of individual students' equipment needs. Educational professionals can use their personal laptops for briefings, demonstrations, experiments, and the development of new experimentations, projects, and prototypes. Sensor interfacing, GUI programming, physical computing, electronic items, microcontroller software, computing, and a wide range of programming languages are all skills that engineers can learn. Hobbyists can invest in a nice device to help them pass the time more efficiently. Innovators can use this tool to illustrate concepts and create unique products.

Fig No. 1. ExpEYES main board

Fig No. 2. Micro:bit

The micro:bit provides an experience that is available to beginners while also providing plenty of overhead for more advanced applications, such as use as an embedded device in class and hobby projects. The micro:bit is a small and fairly priced package that packs a lot of functionality. The Raspberry Pi is an obvious next step for those who want to progress beyond the Micro:bit. It is more difficult to set up, but it supports a wider range of applications, making the Pi an extremely versatile general-purpose computer. The Raspberry Pi is a self-contained computer that runs Linux. There are several models available, including the Raspberry Pi 3 Model B+ and the latest Raspberry Pi 4.

The first step is to connect a keyboard, mouse, monitor, SD card, and USB power supply to a Pi. Raspian, the Raspberry Pi's operating system, must be installed on the SD card. The Pi's 40-pin connector is designed to connect to actuators, sensors, and some other physical computing devices.

Physical computing is defined as "the construction of interactive physical systems" by using software and hardware that can detect and react to the analogue world. It connects a number of mechatronics-related tasks. Computer programming, robotics, electrical, and embedded development are all areas of study. For a long time, physical kits based on microcontrollers and the use of computers in educational contexts have been common for environmental research and scientific interactive art, robotics, and sensing. Arduino is a popular platform for electronic prototyping. It provides a software package as well as hardware to customers in order for them to create interactive electronic things. In comparison to platforms that use microcontrollers, computers with only one board, such as the Raspberry Pi, are used. SBCs are interacted with, and additional information is provided by the display or displays. Process power and capability are exceptional. Memory cards are required for SBCs that have an able to operate system installed and are ready to function as computers.

IV. PROPOSED SYSTEM

The single board computer (SBC) is the system's central component. The SBC is made up of memory, a processor, LAN and WiFi interfaces, and an audio/video interface. Use a memory card or internal memory to store data and load the operating system. Linux's open-source nature and ample supply of free software make it a feasible operating system option. When used as a display device, a graphical user interface (GUI) can be displayed on a standard HDMI monitor or touchpad. When a display lacks a touch screen, the input devices are a standard USB keyboard and a mouse. A single board computer (SBC) includes an external peripheral interface (GPIO) for connecting various sensors and electronic components.

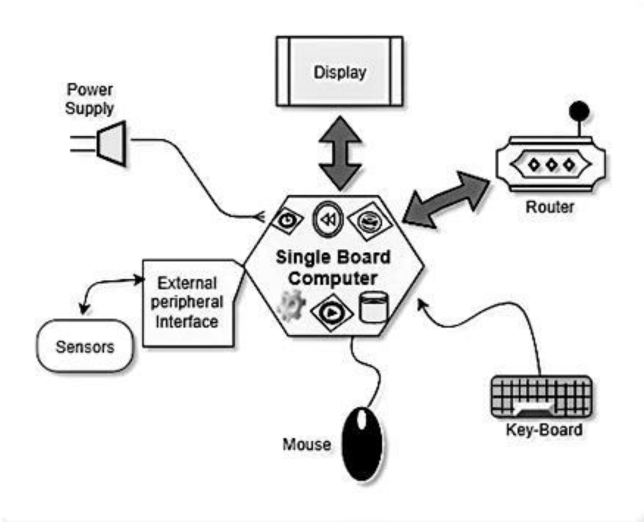


Fig No. 3. Blocked diagram of Proposed System

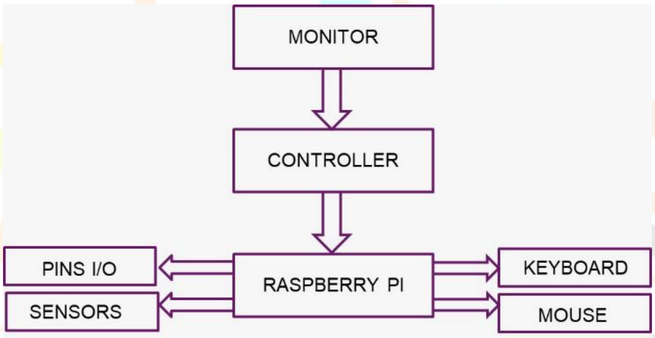


Fig No. 4. Simplified Block Diagram of the Proposed System

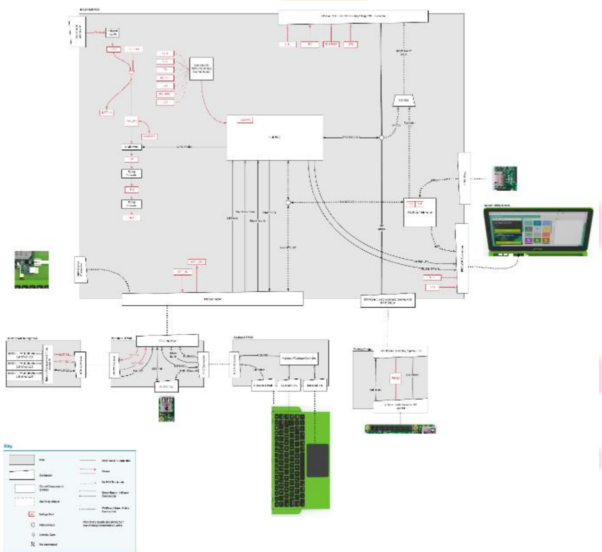


Fig No. 5. Circuit Diagram of the Proposed System

Fig No. 6. Expected Output

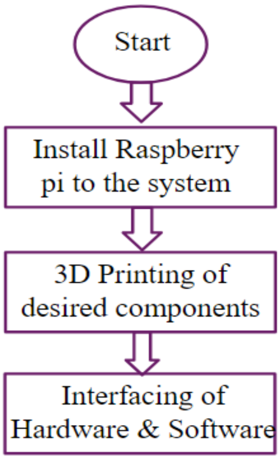


Fig No. 7. Flow Chart

V. RESULTS AND DISCUSSION

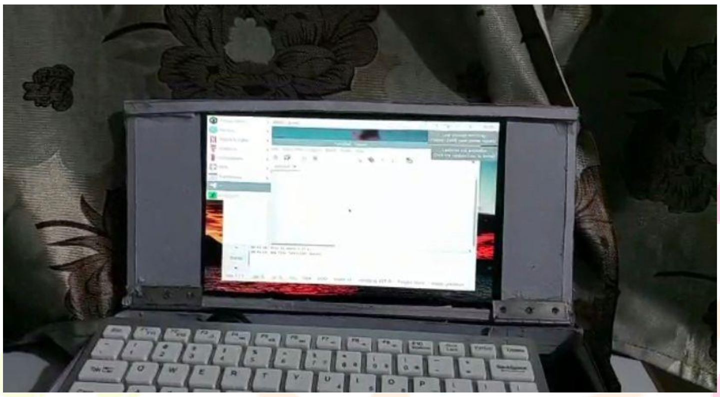
5.1 Conclusion

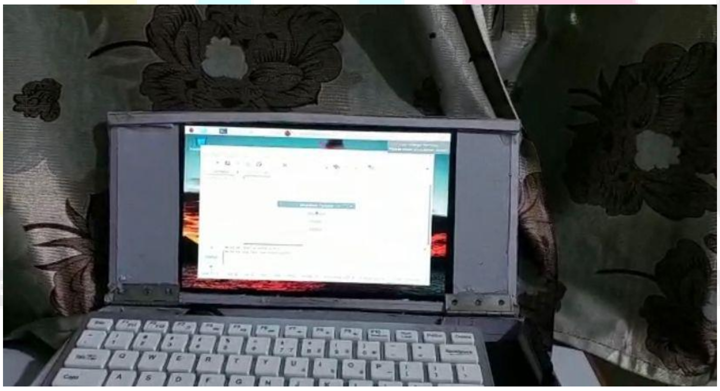
Physical computing is defined as "the creation of interactive physical systems through the use of hardware and software that can detect and respond to the analogue world." Physical computing connects electrical engineering, mechatronics, embedded development, robotics, and computer science. For years, academic institutions have made extensive use of microcontroller-based physical computing devices and toolkits for robotic systems, interactive art, environmental sensing, and scientific experimentation. Arduino is a popular platform for electronic prototyping. It provides users with hardware and software packages that allow them to create interactive electronic objects. There are advantages to using single-board computer systems like the Raspberry Pi over microcontroller-based platforms. SBCs are attached to displays or monitors due to their increased storage capacity and processing power. Because SBCs are tiny computers, they require a memory card to be stuffed with the operating system in order to function as a computer.

This computer was created for educational purposes. It can be used to create word processing documents, spreadsheets, and presentations. It can also penetrate the web and connect with people to the vast variety of accessible resources. It can be used to learn to code, develop software, build circuits, create projects, and so on. Its main advantages are portability and low cost. It has such low manufacturing costs that it is significantly less expensive than most computers. As a result, a lot more individuals can afford them. The Raspberry Pi's performance is compared to a few of the more famous boards and development systems in terms of size, computing power, and overall software costs. Based on the results of the analysis, it can be stated that Udoo has the best performance of all of the regarded IoT hardware platforms, but its price is relatively high. On the other hand, a thorough examination of the Raspberry Pi has revealed that it is the ideal place for a PC in the field of sensor networks. As a result, Raspberry Pi is the ideal platform for interfacing with a variety of external peripherals and is used in a wide range of implementations.

Students' learning abilities can be influenced by communications and information technology. According to our most recent research, teachers who are skilled in the use of digital tools can assist learners in acquiring higher order thinking skills, provide them with distinctive and imaginative ways to articulate what they have discovered, and better equip them to deal with continuing technological change in the actual world and the workplace. To support this educational revolution, India requires cost-effective and cutting-edge educational equipment. Technology is an important component of STEM education. We designed low-cost educational laptop computers for educators, students, and schools. This laptop is easy to use and has direct connection and processing power. The physical computing functionality will assist young students improve their programming skills and creativity.

5.2 Project Output





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