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Towards Intelligent Education: A Raspberry Pi-Based Edge Device For Student Monitoring

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Abstract: The Study Assistant is a novel technological solution designed to ad- dress the common issue of student distraction during study sessions. This study provides an extensive analysis of the development, functionality, and potential impact of the Study Assistant on student motivation and productivity. The Study Assistant leverages facial and eye detection al- girths to monitor students' behavior during study sessions. By accurately identifying instances of closed eyes or signs of disengagement, the system promptly issues alerts and reminders, facilitating the maintenance of focus. Additionally, the assistant incorporates reminders for sedentary breaks and hydration, fostering healthy study habits and mitigating the effects of fatigue. This research paper presents a comprehensive examination of the seamless integration of the Study Assistant prototype, utilizing Raspberry Pi and an array of hardware components. It delves into the implementation of facial and eye detection algorithms and provides a detailed discussion on the recording of study session durations, enabling effective tracking of progress toward predefined goals. The Study Assistant holds considerable potential for enhancing student engagement, minimizing dis- tractions, and promoting optimal study habits. By offering an innovative and supportive solution, this research contributes significantly to the field of educational technology.

Keywords **- Student Motivation, Facial detection and eye detection, Raspberry Pi, minimizing distractions**

Introduction

For The modern era demands for efficiency and consistency from individuals at any domain of work be it student or professional. One can only improve efficiency if the person utilizes the time for work rather than getting distracted and killing time ultimately. And with the improvement in technology, which was supposed to compliment us every way possible suffers from the problem of distracting people. One of the main reasons for distraction is the readily available mobile phones. Even though we try to avoid its involvement in our life it has become nearly impossible because of our dependency on it for basic day-to-day activities like reminders, knowing the time. When students want to study, they keep their mobile phones near them for these requirements and tend to get distracted when there is a notification or an urge to check their social media feed now and then. This takes a toll on the productivity of the person who wants to focus [4][7].

Another problem that plagues students/working individual is the problem of feeling sleepy at work time. There may be various reasons for them to study in spite of feeling sleepy like a deadline or an exam. In this situation, sleep may cause a very big problem and thus will need to avoid it as much as possible. If someone is around, they may keep an eye on that person and may wake them up, what if there is a situation when they are alone. Also, when the person is alone, they can miss the care offered like being asked to take a sedentary break or reminded to drink water. A person wanting to study may sometimes miss the right posture due to their interest in studying. They miss the correct posture and thus tend to suffer from pain which causes to wind up their session earlier. This again leads to a decrease in productivity and might have adverse effect on the person's wellbeing [8]. With a project technology to help the students stay awake and be centralized while studying when no one is present to monitor them. To build and device that will detect their faces and alert them to

correct their posture if it seems bad and unhealthy. By recording the progress and the duration of their study time and collect a log of the data when they are unsupervised. By ensuring ensure that they are nurtured with the care that they might have when being monitored and remind them to take necessary sedentary breaks to keep them stress-free by notifying them about their progress to keep them positive and motivated [2].

Study Assistant is meant to solve the problems that were mentioned previously. Study Assistant comes with a camera that monitors the face of the user when they are studying and notifies them that they are sleeping if the eyes are closed for a prolonged amount of time. With the same camera, it also checks the posture and notifies in the case of a wrong posture [9]. It also records the progress of the user and keeps it readily available which they may use it for analysis for self-improvement. The study assistant acts like a person who cares by offering water breaks and sedentary breaks. It also motivates the user by notifying them about their studying session which gives a positive impact. The target of the study assistant is to provide the users with a feeling that they are monitored and nurtured and to not miss the absence of their loved ones. It also wants to eradicate the need for mobile phones in the study space and to reduce the distractions caused by it. Overall Study assistant wants to provide highly productive study sessions and an enjoyable studying experience [10].

I. Materials Used

1. Raspberry pi 4 model B 8GB RAM
2. 5 MP Raspberry pi camera module
3. LCD Display JHD204A(20x4)
4. Wired Speaker
5. Potentiometer 10K
6. Buttons
7. Heat sink
8. Bread Board
9. Jumper wires.

II. Software Used

1. PuTTY
2. pi IMAGER

III. Methodology

4.1 Raspberry pi and adapter

Raspberry Pi is a Micro-controller cum microcomputer device which serves as an independent computer system for our Study assistant program to run on. Raspberry pi has dedicated operating system which has to be installed in a SD card that serves as EEPROM (Electronically erasable Programmable read only memory) in a computer [5].

4.2 Pi camera

Pi camera module (5MP) is an input device that inputs optical data to the raspberry pi through the camera slot. The optical data is passed frame by frame to the Raspberry pi. These sequences of frames are read and interpreted by our study assistant program [3].

4.3 LCD Display

Liquid crystal display of 20x4 character size has been used in this project to serve as an output device and as the face of the device. The LCD display shows time and text reminder to the users so that they can keep a track of their study time and can check for reminders when they are alerted by the speaker. [6]

4.4 Wired speaker

The speaker gives phonic reminders and status of the device (ON/OFF). The audio used to remind is pre-recorded audio for each reminder and alert using Play.ht. These audio files are in MP3 format stored in the raspberry pi system which resides in the SD card that has the operating system of raspberry pi.

4.5 Push Button for input

The study assistant features 2 push buttons which are used for starting/stopping of the study session record and responding to the reminder given respectively.

IV. WORKING PRINCIPLE

The study assistant's main program consists of a main loop which ensures that the program doesn't get terminated. The program enters the infinite loop after the initialization and import of the respective libraries. To start the study session, the user has to press the study session (ON/OFF) button. The signal passed by the button is read through the (–pin number) of the raspberry pi Pinouts. Upon receiving this signal, the if condition is satisfied which starts the study session. During the study session the camera records video of the user to analyze his focus on the session. This is done using Haar's cascade face detection algorithm which recognizes the face of the user [1]. The face of the user is not detected, if his posture is not normal to the camera. If the face of the user is not detected for 1000 iterations which takes approximately 2-3 minutes to execute then the study session is saved and ended automatically by the algorithm. Therefore, posture also comes into play along with the case if the person is not present there. After 40 minutes of study a reminder is given asking whether the user wants to take a break of 5 minutes, if the user responds to it by pressing the other button which is for responding to the reminders, then the program halts for five minutes (sleep () function). After 5 minutes the user is alerted about the resumption of his/her study session. If the user didn't respond to the reminder, it is considered as a no and the user will be reminded again after 20 minutes successively, he/she keeps on ignoring the reminder. If break time is used once the next break time will be after 40 minutes. When the user ends the study session by pressing the on/OFF button or automatically ended by the algorithm, the study session's information like start time, end time and date are saved in the specified .csv (comma separated values) file. This csv file will hold the record of all the study sessions which can be used to analyze the study pattern of the user using a dedicated mobile application.

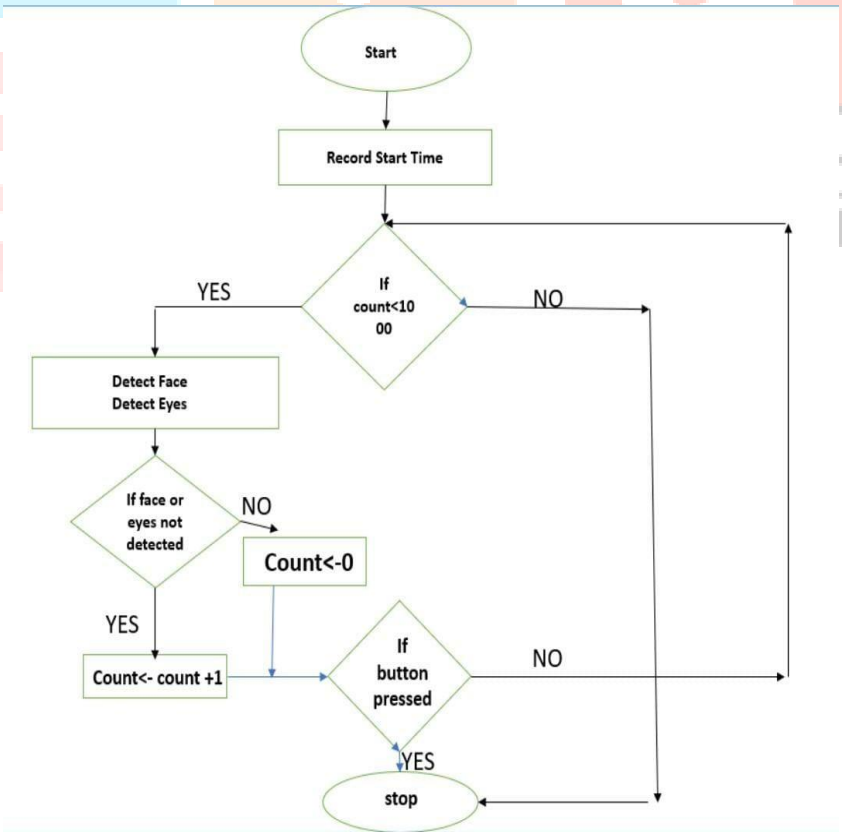

Figure 1: Flow chart

V. IMPLEMENTATION

The OS for raspberry pi 4 Model B+ is chosen which in our case is Debian bullseye patch march 2023 using Pi Imager software in a SD Card. This SD card is inserted into the raspberry pi's SD card slot. The Camera module is connected in its respective slot. Then a button is connected in series with a 1 kilo ohm resistor such that it connects the power source 3.3V PWR D1 with GPIO 21. This button is used for starting and stopping of a study session. Similarly, another button is connected in series with a 1 Kilo ohm resistor such that it connects the power source 3.3v PWR D1 with GPIO 20. This button serves the purpose of responding to reminders. If the user presses the button, it is considered as a" YES" for reminder else by default it is taken as a" NO". The 20x4 LCD screen is connected to the raspberry by the following pinout connections:

LCD display pins	Raspberry pi pins
(1) VSS	Ground
(2) VDD	5V
(3) VO	potentiometer
(4) RS	D32 (GPIO32)
(5)R/W	Ground
(6)E	D26(GPIO7)
(11) DB4	D24(GPIO8)
(12) DB5	D22(GPIO25)
(13) DB6	D18(GPIO24)
(14) DB7	D16(GPIO23)
(15)A	5V
(16)K	Ground

The raspberry pi is connected to the power source with the help of the official USB-C raspberry pi 4 adapter which outputs 5.1V and 3 A.

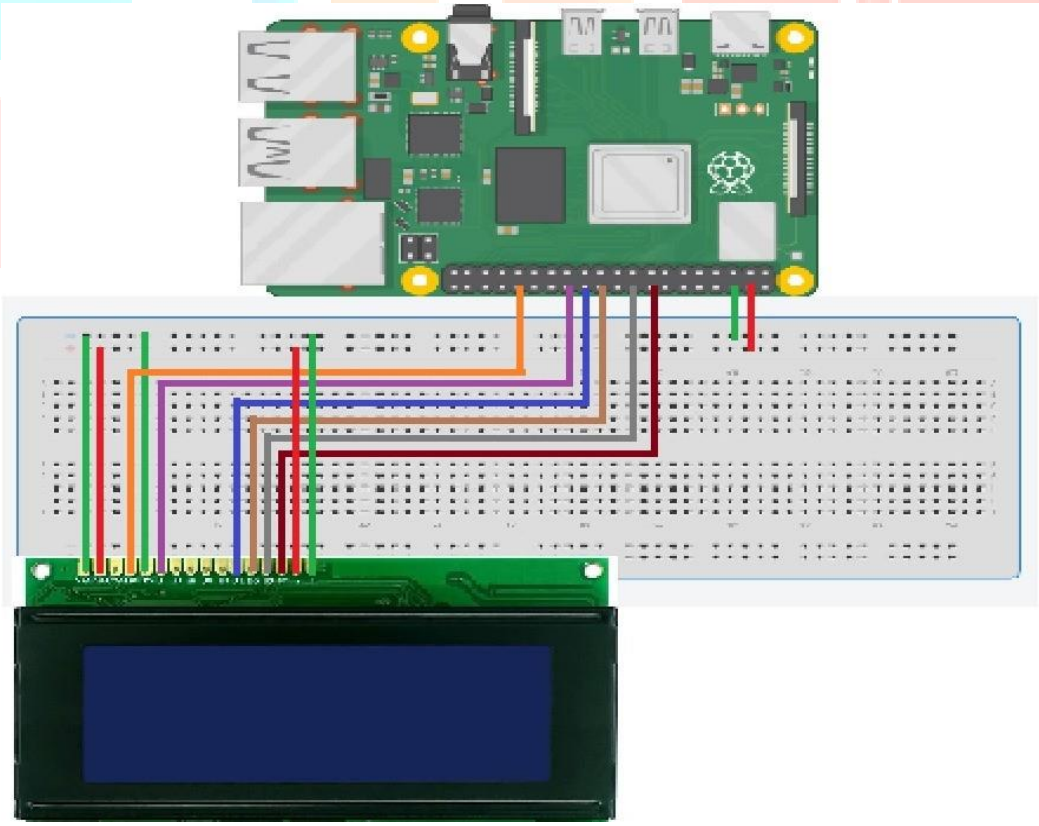

Figure 2: Circuit Diagram

Figure 3: Pin Diagram

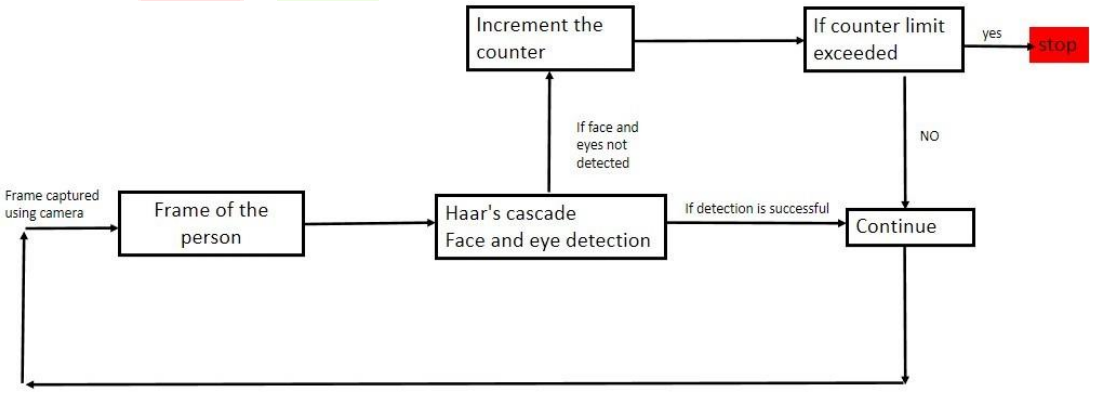

Figure 4: Input-Output processing chart

VI. RESULTS AND DISCUSSION

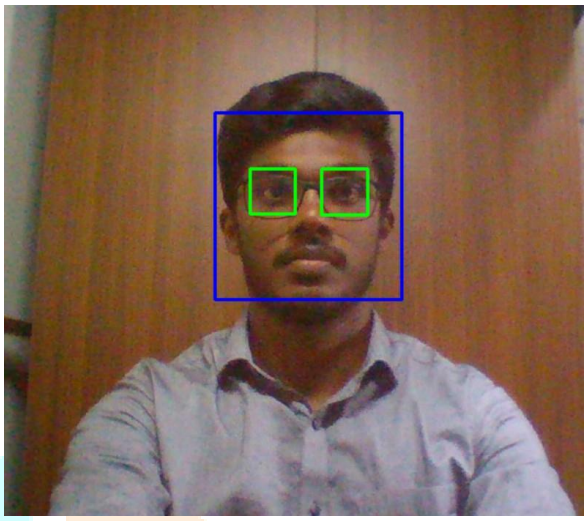

Figure 5: Face and detection with spectacles

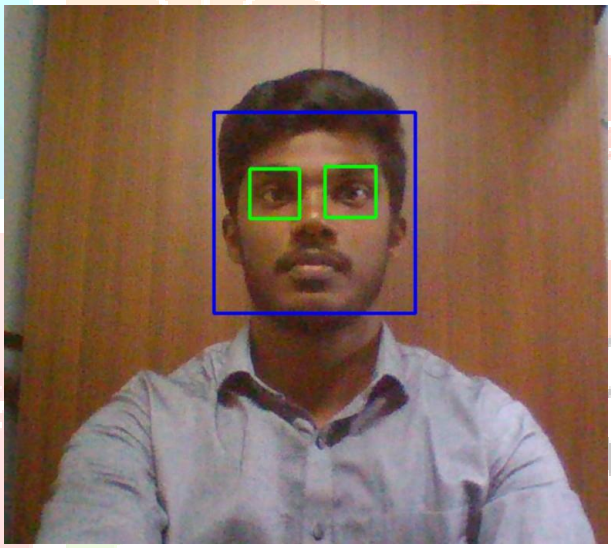

Figure 6: Face and detection without spectacles

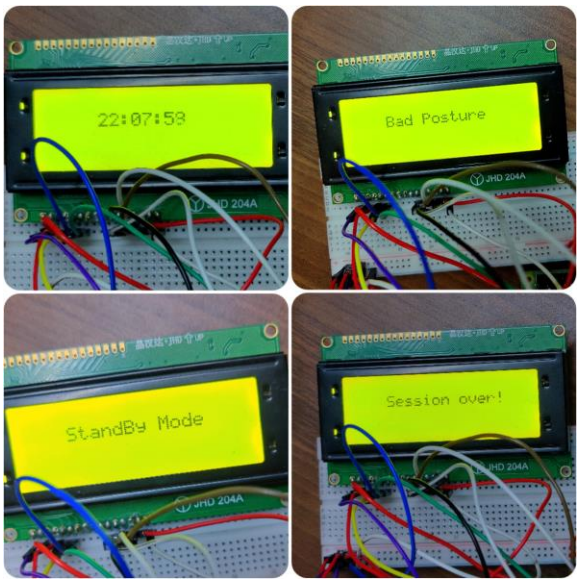

Figure 7: a) time of study b) Wrong body posture c) Standby mode d) after pressing stop button

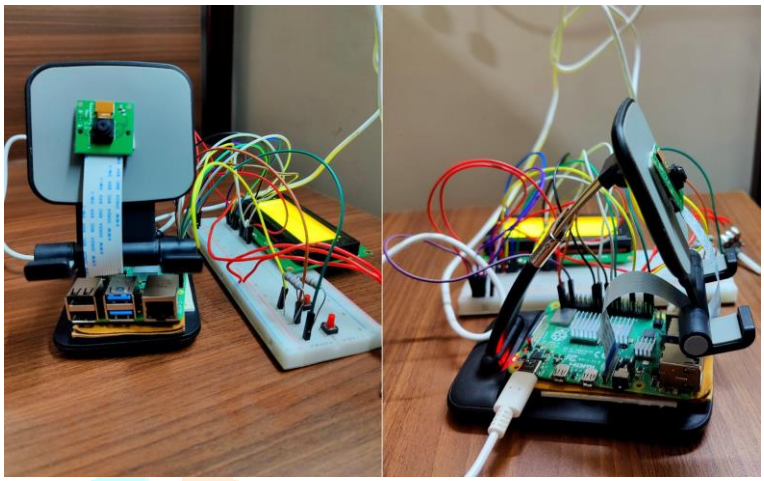

Figure 8: Both side view of study assistant

VII. Conclusion

Since the demand for gadgets improving the efficiency of work/study, the Study Assistant exactly fits the mold. Study Assistant provides the users with information regarding their posture and work time, which has a considerable effect on the efficiency of work/study. The proposed gadget helps the user to avoid body pain and other issues related to bad posture. This helps the worker to concentrate on his/her work and not wander off. In the case of students, busy Parents can be aware of their ward's activity in the domain of work/studies.

References

[1] L. Cuimei, Q. Zhiliang, J. Nan and W. Jianhua," Human face detection al- gorithm via Haar cascade classifier combined with three additional classifiers," 2017 13th IEEE International Conference on Electronic Measurement Instru ments (ICEMI), Yangzhou, China, 2017, pp. 483-487, doi: 10.1109/ICEMI.2017.8265863.

[2] B. Balon and M. Simi´c," Using Raspberry Pi Computers in Education," in 2019 42nd International Convention on Information and Communication Tech- nology, Electronics and Microelectronics (MIPRO), Opatija, Croatia, 2019, pp. 671-676. doi: 10.23919/MIPRO.2019.8756967.

[3] I. Gupta, V. Patil, C. Kadam, and S. Dumbre," Face detection and recognition using Raspberry Pi," in 2016 IEEE International WIE Conference on Electrical and Computer Engineering (WIECON-ECE), Pune, India, 2016, pp. 83-86. doi: 10.1109/WIECON-ECE.2016.8009092.

[4] Gowthami, S. and Kumar, S.V.K., 2016. Impact of smartphone: A pilot study on positive and negative effects. International journal of scientific engineering and Applied Science, 2(3), pp.473-478.

[5] S. Narang and Y. Bansal," Raspberry Pi and image processing based Electronic Voting Machine (EVM)," in International Journal of Scientific En- gineering Research, vol. 5, issue 1, January 2014, ISSN 2229-5518.

[6] V. Chaitanya and S. S. Kirubakaran," Online notice board using Rasp- berry Pi using putty software and internet of things," in AIP Conference Pro- ceedings 2519, 030055 (2022). doi: 10.1063/5.0065964.

[7] Masiu, Tokelo Mpho, and Joshua Ebere Chukwuere." The effect of smart- phones on students' academic life: A perceptive from a South African Univer- sity." International Conference on Business and Management Dynamics. 2018.

[8] Habiburrahman, Muhammad Lesmana, Elvira Harmen, Fadhilah Gra- tia, Nadya Mirtha, Listya. (2021). The Impact of Sleep Deprivation on Work Performance towards Night-shift Healthcare Workers: An Evidence-based Case Report. Acta medica Philippina. 55. 650-665. 10.47895/amp. v55i6.3157.

[9] R. Gupta, D. Saini and S. Mishra," Posture detection using Deep Learning for Time Series Data," 2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT), Tirunelveli, India, 2020, pp. 740-744, doi: 10.1109/ICSSIT48917.2020.9214223.

[10] Qazdar, Aimad Qassimi, Sara Hasidi, Oussama Hafidi, Meriem Ab- delwahed, El Hassan MELK, Youssef. (2022). Learning Analytics for Tracking Student Progress in LMS. 10.21203/rs.3.rs-1505417/v1.

[11] Chellappa, Akalya Reedy, Mandi R R, Ezhilarasie S., Kanimozhi Su- guna Umamakeswari, Arumugam. (2018). Fatigue Detection Using Raspberry Pi 3. International Journal of Engineering and Technology (UAE). 7. 29-32. 10.14419/ijet. v7i2.24.11993.