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An Intelligent Mobile Phone Stand for Posture Correction and Musculoskeletal Discomfort Reduction

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Abstract

Mobile phones have become an integral part of our lives, and this is especially true for mobile users in Saudi Arabia. Therefore, people frequently adopt harmful postures when using smartphones for extended periods of time, bending their neck and upper torso forward, which leads to disorders like cervical myalgia. To prevent these disorders, this study aims to design, develop, and test an AI-based smart stand for mobile phones that automatically adjusts height and distance according to user head posture, reducing musculoskeletal discomfort and improving ergonomics. Ten participants were randomly assigned to two different conditions: smart stand use and traditional stand, utilizing basic randomization to mitigate possible systematic bias arising from the sequence of experiments. All individuals experienced both situations on different days. Body discomfort rate, usability, and user experience were collected for each participant after 10 min of chatting, 10 min of watching video, and 10 min of web surfing on a smartphone. The

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results showed that participants who use Smart Stand led to enhanced user performance and reduced neck and shoulder discomfort as compared to traditional stands. The SUS indicates unfavorable evaluations for the traditional stand regarding both perceived utility and perceived ease of use. The smart stand was considered highly beneficial and user-friendly. The smart stand automatically adjusts the optimal height of the stand 's eye center and the distance between the user and the device, ensuring maximum comfort and reducing physical strain, particularly on the neck. The smart stand greatly enhanced the quality of life.

Keywords
Smart Stand, Smartphone Usage, MSDs, Ergonomics, User Quality of Life.

1. Introduction
Information and communication technology (ICT) apparatus has been utilized throughout several industries, including industry and education. Employees and students utilize various ICT devices, including desktop computers, laptops, tablets, and cellphones. Smartphones are rapidly becoming an indispensable component of our day-to-day lives (Alfaitouri & Altaboli, 2019) , serving a wide range of purposes, including but not limited to the entertainment, information, communication, business, commerce, and educational demands (Dogra & Sharma, 2024; Samaha & Hawi, 2016). At least 77% of the world's population have a mobile phone(Al-Hadidi et al., 2019). Study underscores the significant social use of mobile phones, encompassing gaming, messaging, and video viewing (Chan et al., 2023; Dlodlo & Mahlangu, 2013). Dlodlo & Mahlangu, (2013) found strong links between these activities and youth, influenced by enjoyment, dependency, and addiction. Chan et al. (2023) similarly emphasized popular recreational uses like chatting, gaming, music, and video consumption. They emphasized their application for internet browsing and learning goals. Chan et al. (2023) highlighted the evolution of mobile phones over the past two decades, from communication tools to devices central to information-seeking, entertainment, relaxation, and financial management, demonstrating their expanded role in modern life. Mobile phones have become indispensable instruments for accessible and varied learning experiences globally.

According to a survey conducted in 2020, 86% of Saudi Arabia's population are active social media users, with YouTube, Instagram, and Twitter being the most popular platforms. Social media platforms are not only used for socializing but also for staying up to date with the latest news, politics, and entertainment. In addition, there was a significant jump in the percentage of phone use, as data showed that 97.7% of the population over the age of 15 own a mobile phone (98.7% of males and 96.3% of females). The percentage of individuals (15 years and above) who used mobile phones reached 98.2%. In Switzerland, 97% of teenagers possess a smartphone (Haug et al., 2015). In the United Kingdom, 60% of teens exhibit significant dependence on their smartphones. The prevalence and ownership of smartphones among adolescents globally have surged quickly in recent years (Olson et al., 2022). Although smartphones offer several benefits, they may elevate the risk of musculoskeletal diseases (MSDs), particularly in the cervical and shoulder areas. (Tapanya, Neubert, et al., 2021). The discomfort experienced in the neck by smartphone users has garnered more attention from the general populace lately due to the rising prevalence of mobile device use in forward head flexion positions. Smartphone users often grasp the device with one or two hands positioned below eye level, gaze downward at the screen, and mostly use their thumbs for typing or interacting with the touch display(Gold et al., 2012). Individuals often sustain a forward flexion posture of the head despite experiencing pain or discomfort in the neck (Alfaitouri & Altaboli, 2019; El Shunnar et al., 2024; Maniwa et al., 2013). It has been posited that the extended and/or frequent utilization of smartphones while in a pronounced head flexion position may significantly contribute to the prevalence of neck pain among smartphone users.

According to research by Lee et al. (2015), when using a smartphone, participants kept their heads cocked to the side at an angle between 33 and 45 degrees from vertical. When compared to the other jobs, texting required a much greater angle of head flexion, and when compared to standing, sitting required an even greater angle. There has been an increase in the number of individuals using smartphones, driven by concerns about musculoskeletal disorders linked to extended cellphone usage. Berolo et al. (2011) revealed that people who use mobile devices had a tendency to report experiencing discomfort in their neck, shoulder, and thumb. Furthermore, the degree of the pain sensations rose with the total amount of time that they spent using their mobile devices. Chen & Chan, (2024) advocated keeping the head angle within 20° due to the comparatively modest stress on the neck and shoulders. Tapanya, Puntumetakul, et al. (2021) shown that people should keep a neck posture of 0 degrees flexion when texting in a standing position to minimize gravitational strain on the cervical spine and mitigate neck pain.

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The prevalence of MSDs has been found to be associated with the pattern of smartphone use, including: session length of use >1 h, type of activities, multitasking (Toh et al., 2020) and total daily time spent (hours per day) using a smartphone (Fook et al., 2021; Wilcockson et al., 2018). Also, smartphone users often gaze downward or extend their hands forward to see the screen, resulting in forward head posture and an exaggerated anterior curve of the cervical vertebrae. An excessive posterior curvature will manifest in the upper thoracic vertebrae to maintain equilibrium, while also exerting strain on the spinal and cervical musculature (AlAbdulwahab et al., 2017; Shete & Shah, 2019). When a person uses a mobile phone while standing up straight, their neck is in its "neural position," or reference position. Viewing a phone at an angle that puts the least strain on the cervical spine, known as the neutral angle, is the best position for the neck. According to Norasi et al., (2022), a larger likelihood of musculoskeletal diseases is associated with neck flexion angles greater than 20°. Local studies have shown that about one-third to one-half of smartphone users face problems related to excessive use. Some research suggests that problematic smartphone use can negatively affect sleep, energy levels, mood, eating habits, weight, physical activity, and academic performance. Alghnam et al. (2018), and Kim et al. (2017) showed that excessive smartphone use can lead to negative functional effects, such as feeling depressed or anxious when the phone is not within reach, and using the phone in risky situations such as driving. These problems have been linked to issues similar to drug addiction, such as financial problems and breaking laws. Children under 8 to 14 years are at a heightened risk compared to adults for developing musculoskeletal issues due to the rising prevalence of cell phone usage within this age group (Fowler & Noyes, 2017).

To prevent these disorders, ergonomic standards, guidelines, and different stands have been recommended. People should maintain the smartphone at eye level, often alter their posture, and minimize smartphone usage duration. Nevertheless, people may fail to acknowledge these concerns, and even when some do, many may not sufficiently focus on maintaining proper posture when engaged with their smartphones. An advisable ergonomic posture involves supporting the forearm to maintain the shoulder in a neutral position (Cook et al., 2004; Zhu & Shin, 2012) which may effectively diminish muscle strain and fatigue in upper arms. Chair assistance, through armrests and backrests, has been demonstrated in mobile phone users to decrease upper arm stress (Syamala et al., 2018). H. Lee et al. (2013) introduced an innovative mobile posture monitoring device that analyzes the users physical activity during smartphone use. The suggested system alerted the user to their improper posture through different methods, including vibration, SMS notifications, or auditory alarms.

Different stands are available in the markets such as fixed stand, magnetic stand, foldable stand, and hanging stand. The fixed stand is characterized by a simple and stable design. It is ideal for use on desks or tables. The magnetic stand uses magnets to hold the device. It is easy to use and suitable for cars or metal surfaces. The foldable stand can be easily folded to carry on the go. It is ideal for travel or use in public places. The hanging stand can be hung on the wall or ceiling. It saves space and is a modern option. Most prior investigations concentrated separately on musculoskeletal disorders, ergonomic analyses of thumb motions, reachability, and performance challenges. Each type of stand has its own advantages and uses, but does not provide the best choice for individual needs. Consequently, this study presents a smartphone stand designed to address ergonomic issues related to mobile phone usage. Previously, no studies were reported on smartphone stands to solve ergonomic issues related to mobile phone usage. This study aims to design and develop a smart holder for tablets and mobile phones that is capable of adjusting the height and distance of the stand according to user head posture using IA. The novelty of this study lies in the integration of AI, robotics, and ergonomics to create a proactive, intelligent system.

1.1 Research Questions

This study designed to answer the following question: How does the AI-powered phone holder's automated adjustments impact user ergonomics and experience compared to standard alternatives?

1.2 Objectives

This study developed an AI-powered smartphone holder that automatically adjusts the device's distance and height based on the user's head position. The system analyzes real-time facial data to optimize device placement, offering a hands-free experience while improving user comfort and reducing health risks like neck strain and eye fatigue.

2. Literature Review

Numerous people utilize smartphones in their daily lives. Nearly 56 percent of the United States population utilizes cellphones, dedicating an average of 5.1 hours daily to their use (Kong et al., 2017). By the end of 2025, there will be 7.43 billion smartphone users, up from 6.34 billion in 2021 (Taylor, 2023) as in F 1. According to studies on

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smartphone usage, the typical person uses their device is 2 hours and 51 minutes per day (Marko, 2023). In a recent survey, the use of mobile devices, including smartphones, to access different social media accounts was found to have significantly increased in Saudi Arabia. LinkedIn continues to lag behind the significant rise in the number of users on WhatsApp, Facebook, Google+, Twitter, and Instagram. In Saudi Arabia, WhatsApp was the most widely used messaging app worldwide as of September 2015, with up to 900 million users (Guynn, 2015) (Figure 1).

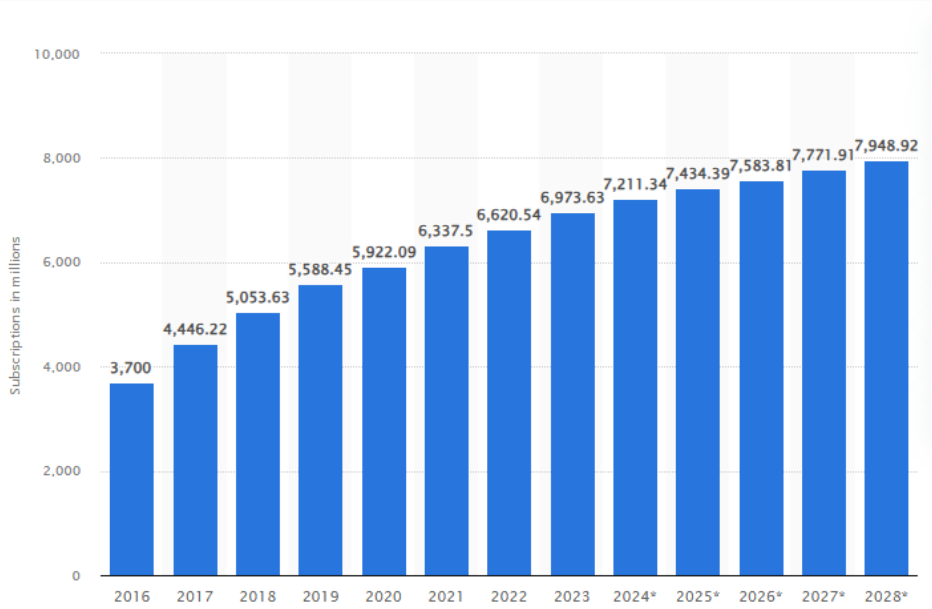

Figure 1. Number of smartphone mobile user worldwide from 2016 to 2023, with forecasts from 2023 to 2028 (Source: Statista 2024;(Taylor, 2023).

Excessive smartphone usage results in tiredness in the neck, shoulder, and finger; visual strain; and addiction. Poor posture and musculoskeletal pain were observed among IT users. According to Namwongsa et al., (2018), university students who used smartphones experienced neck pain. A primary contributor to neck pain is the prolonged usage of tablets on one's lap. (Chiang & Liu, 2016; Young et al., 2012). Furthermore, using a smartphone for 20 minutes while in three different postures—lap, chest, and table—significantly elevated pain in the arm, shoulder, upper back, and neck (Intolo et al., 2016). Incorrect posture was observed in individuals with a neck flexion angle of 65 degrees, while standing and sitting positions exhibited just a 16-degree neck flexion angle (H. Lee et al., 2013). Elevated flexion of the neck angles while smartphone and tablet usage augment the impact of the arm on the cervical spine, resulting in injuries to both the cervical spine and the adjacent tissue of the skin (Albin & McLoone, 2014; Hansraj, 2014). Furthermore, the neck, torso, and lumbar regions appeared in a bent position during smartphone usage (H. K. Kim et al., 2020). A prior study indicated that muscular discomfort in the majority of individuals was predominantly located in the Levator scapulae and Upper trapezius muscles (Andersen et al., 2011). Several attempts have been made to solve the above-mentioned problems. Additionally, several standards exist for consumers when utilizing cellphones. Minimizing prolonged position alleviated pain in users. It is advised to alter one's position every 15 to 20 minutes and to take a rest every 30 to 60 minutes (International Ergonomic Association, 2016). Syamala et al. (2018) examined the influence of assistance on neck and shoulder muscle activity during smartphone use in a seated position and discovered that seat backrests decreased muscular activation in these areas. Various academics have suggested diverse approaches and strategies for alleviating neck and shoulder discomfort. An examination of patents related to the placement of tablets on surfaces reveals a wide array of methodologies.

Farra et al. (2011) designed a device for tracking for tracking the health of the spinal column through assessing the tilt of the individual's upper back and the tension put on the spine. They employed customized sensors, comprising an inclinometer at the neck and load cells at the footwear. Additionally, Hong et al. (2012) created an electronic part named SEPTIMU, integrated into standard earbuds, to assess the postures of the user. This system primarily focuses on detecting posture changes by analyzing the collected sensor readings. Schrempf et al. (2011) established a framework for classifying sitting postures by incorporating four force transducers into a traditional chair. They developed a posture cost function based on a biomechanical model, enabling them to identify postures that may

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contribute to lower back pain. While this method is effective for indoor environments like offices, it is not suitable for mobile phone usage. In contrast, Baek & Yun, (2010) suggested a system for detecting user postures while utilizing a mobile phone during three activities: sitting, standing, and walking. The tilt angle between the gadget and the Earth's surface was determined using data from a 2-axis accelerometer affixed to the device. Their emphasis was on activity detection and context awareness rather than detailed health-related posture tracking, as they did not address the specific conditions of the user's body parts.

Arteaga et al. (2008) introduced an accelerometer-based system for tracking posture, particularly tailored for survivors of stroke. They created a tracking apparatus that comprises a 3-axis accelerometer, a beeper, an LED light, and a vibrator. This system is equipped with ten monitoring devices strategically placed on various body parts, such as the knee, shoulder, and wrist of participants. When the system detects poor posture repeatedly, it issues a warning to the user and logs the instances of inappropriate posture for further analysis. H. Lee et al. (2013) developed a Mobile Posture-Aware System aimed to reduce the physical health risks associated with smartphone use. They proposed a novel methodology for monitoring the posture of smartphone users through built-in sensors. This system estimates values that represent user postures, such as head and neck tilt angles, by analyzing data from a front-facing camera, a 3-axis accelerometer, and an orientation sensor. If the estimated posture values remain outside a defined normal range for a specified duration, the system alerts the user.

Stevens & Augood, (2015) created the Computer Tablet Holder, a gadget designed to securely grab the tablet in a comfortable manner, however necessitates manual support. Girault, (2016) created a Multi-Media Tablet Holder, akin to the "Tablet Holder," but including a string for hands-free use. The "Tabbi" is an innovative idea that can adhere to almost any surface using a revolutionary gel suction cup. An idea closely related to the TREC-E is an adjustable arm system constructed from slender tubes, which may be contorted into diverse configurations, often affixed to a tabletop using a screw clamp. The adjustable arm facilitates various viewing angles. Nevertheless, the slender tube lacks substantial stability. When fully stretched, it becomes somewhat fragile and challenging to handle. Simon, (2017) designed a support for hand held electronic devices which have display screens for viewing text, drawings, photos, movies, etc., such as smart phones and tablets. The usual way for viewing such devices is to hold the device positioned in the vicinity of the person's lap or waist so that the person must tilt his or her head downwardly to view the display screen and any keyboard provided. Galvez, (2017) presented a stand for personal viewing of a mobile device. The stand for personal viewing of a mobile device includes a tripod, a user-interface, and a pivoting head mount, useful for orienting a mobile device for a user to view the mobile device screen without holding the mobile device in their hands. (Scott, 2018) developed a system for reducing or eliminating neck and back pain while using mobile devices. A support assembly is configured to selectively hold the mobile device at or slightly below eye level and a support pillow is configured to provide support for arms of the user during selective engagement with the mobile device. Adjustable stanchions of the support assembly facilitate adjusting the height and position of the mobile device to accommodate users of different heights and to accommodate different viewing preferences while still encouraging improved posture for each user. Sanders, (2019) invented an adjustable stand for tablet computers and electronic reader devices wherein the same can be utilized for providing convenience for the user when reading from such devices.

Innovative options, including posture-monitoring feedback, prism glasses, ergonomic arm support prototypes, and exoskeletons, have shown preliminary efficacy in alleviating muscular tension (Govaerts et al., 2024; Grazi et al., 2024; S. Kim et al., 2024; Lind, 2024; Tang et al., 2021; Tapanya, Puntumetakul, et al., 2021). The neck-mounted smartphone holder, an ergonomic solution intended to reduce neck flexion by positioning the phone at eye level. This device may mitigate the need for forward head position, so alleviating tension on the cervical spine and adjacent muscles, perhaps reversing the adverse effects of detrimental postural habits. Therefore, this study proposed a smartphone stand to solve ergonomic problems associated with mobile phone usage. Prior ergonomic tools typically offer static or manual adjustments, requiring users to remember to maintain proper posture and providing only passive alerts for correction. In contrast, a proposed AI-based smart stand utilizes AI and computer vision for automatic, dynamic adjustment of a mobile phone's position based on real-time head posture tracking, offering proactive and seamless correction without user intervention. This study aims to design and develop a smart holder for tablets and mobile phones that is capable of adjusting the height and distance of the stand according to user head posture using IA.

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3. Methods

3.1 Apparatus

The software and the hardware that used in this study are facial recognition software, Arduino Integrated Development Environment - or Arduino Software (IDE) , Python, Motor Control Libraries and AI libraries, Microcontroller (Arduino), robot arm with 4 degrees of freedom, AI Camera (HuskyLens), jump wires, connectors, servo motors, motor drivers, power supply, and breadboards. Table 1 presents the software and hardware used in this study with its functions.

Table 1. Software and hardware of this study

Components	Function
Facial recognition software	analyze and recognize human faces in images and videos
Arduino Software (IDE)	contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions, and a series of menus.
Python	open-source, high-level programming language celebrated for its readability and efficiency
Motor Control Libraries	Collection of software libraries that help in developing motor control applications
Arduino	shares common features with other computers, use random-access memory (RAM) to store variables.
Robot arm	carrying phone and tablet , reach different angles
AI Camera (HuskyLens)	Face recognition using artificial intelligence, , object tracking, object recognition, line tracking, color recognition, tag recognition and object classification.
Jump wires	Interconnect components on a breadboard
Connectors	Connect electrical or electronic circuits
Servo motors	Precise control of position and speed through a closed-loop system with sensors and a control unit
Motor drivers	Control electric motors, controlling speed and direction
Power supply	converts electrical energy from a source into a suitable form for electronic circuits
Breadboards	Test a circuit
Buzzer	Alert the user or indicate that the maximum movement limit has been reached
PIR sensor	Track the person's movements

3.2 Electrical Circuit Design of Stand

The stand consisted of Arduino board, Robot Arm 3 DOF, Buzzer, PIR Sensor, and AI camera. An Arduino board was for controlling the stand. A Three -degree-of-freedom robotic arm was used for allowing a stand to move in all directions (forward and backward, left and right, and up and down) which maintaining a healthy sitting posture for the individuals. The Buzzer will be employed to alert the user or indicate that the maximum movement limit has been reached. Additionally, a PIR sensor will be utilized to track the person's movements; while an AI camera will be used for Face Recognition. Figure 2 shows the circuit diagram & connection of stand.

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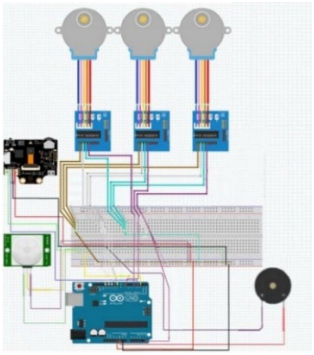

Figure 2. The circuit diagram & connection of stand

3.3 Robotic Arm Kinematics Design

The robotic system used in this project is a 2-R (two-revolute-joint) robotic manipulator, which allows the phone or tablet to move within a planar workspace. To ensure accurate tracking of the user's face, we employed both forward and inverse kinematics.

- Forward kinematics determines the end-effector's position based on the known joint angles and arm lengths using trigonometric equations.
- Inverse kinematics is essential to calculate the joint angles required to move the phone to a desired position detected by the face-tracking AI camera (HuskyLens). This is particularly important to maintain ergonomic viewing distance and angle.

The inverse kinematics of a 2-R arm typically provides two possible solutions (elbow-up and elbow-down), computed using the law of cosines and trigonometric identities. These calculations allow dynamic adjustment of the stand in real time in response to user movements.

This integration of kinematics with AI vision enhances the smart holder's ability to follow the user's position automatically and comfortably. It plays a critical role in supporting our goal of improving user posture and reducing physical strain during mobile device use.

A 2-R (two-revolute-joint) robotic manipulator, commonly used in planar tasks, can be effectively designed to follow and interact with human figures by leveraging both direct and inverse kinematics. In such a system, the robot comprises two rotational joints connected by rigid links, enabling movement within a 2D workspace. Direct kinematics involves calculating the end-effector position from known joint angles and link lengths. This is typically achieved through trigonometric equations where the (x, y) coordinates of the end-effector are derived using the sum of link vectors rotated by their respective joint angles. For a 2-R robot, the direct kinematics equations are:
The Denavit-Hartenberg (D-H) parameters for a 2-R robot are defined in Table 2:

Table 2. D-H parameters of SCARA Robot

Link	a_i	α_i	d_i	θ_i
1	l_1	0	0	θ_1^*
2	l_2	0	0	θ_2^*
3	0	0	d_3^*	0
4	0	0	d_4^*	θ_4^*

In contrast, inverse kinematics deals with determining the necessary joint angles to reach a specific end-effector position, which is essential when the robot must track or follow a moving human figure. The inverse kinematics problem for a 2-R robot typically yields two possible solutions (elbow-up and elbow-down configurations) and involves computing the angles based on the target position using the law of cosines and trigonometric, as Figure 3.

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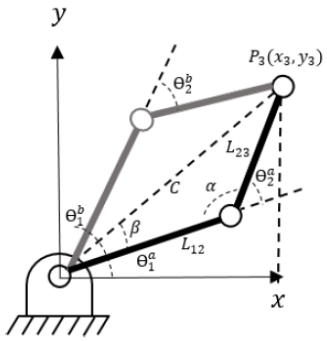

Figure 3. 2R Planar Manipulator

In the context of human tracking, vision or motion capture systems are used to detect the position of key human body parts, which then serve as input targets for the robot's end-effector. Real-time inverse kinematics solutions are computed to ensure smooth and responsive motion, allowing the robot to mimic or assist human actions within its reachable workspace. This synergy of kinematics and perception enables the robot to perform tasks such as object handovers, gesture recognition, or physical collaboration, enhancing human-robot interaction in applications ranging from assistive technology to cooperative manufacturing.

3.4 Stand Working Principle

Figure 4 shows the flow chart for the stand. The process begins by powering on the system and positioning the stand in an appropriate starting position. If motion is detected in front of the stand by a motion sensor, the AI camera is activated to perform face recognition. If a face is recognized, the system determines the person's location and checks if they are in the correct and healthy posture. The stand's position is then adjusted to match the person's posture. If the face is not recognized, the user is prompted to adjust their position appropriately in front of the camera. In cases where motion is detected but no face is recognized or no person is present, the system will shut down. Once a face is recognized and the posture is correct, the system processes the areas where the face has been identified. The system is divided into four zones (Zone 1, Zone 2, Zone 3, Zone 4), and it sends signals to the robotic motor to adjust the field of view appropriately for each zone. The robot tracks the person's face by adjusting the stand's position in four directions: right, left, up, and down. If the stand continues to move to keep the face in an appropriate position but the motors cannot track it, a siren will sound to alert the person that their position is outside the stand's limits. If there is no response within a certain timeframe, a signal will be sent to shut down the system.

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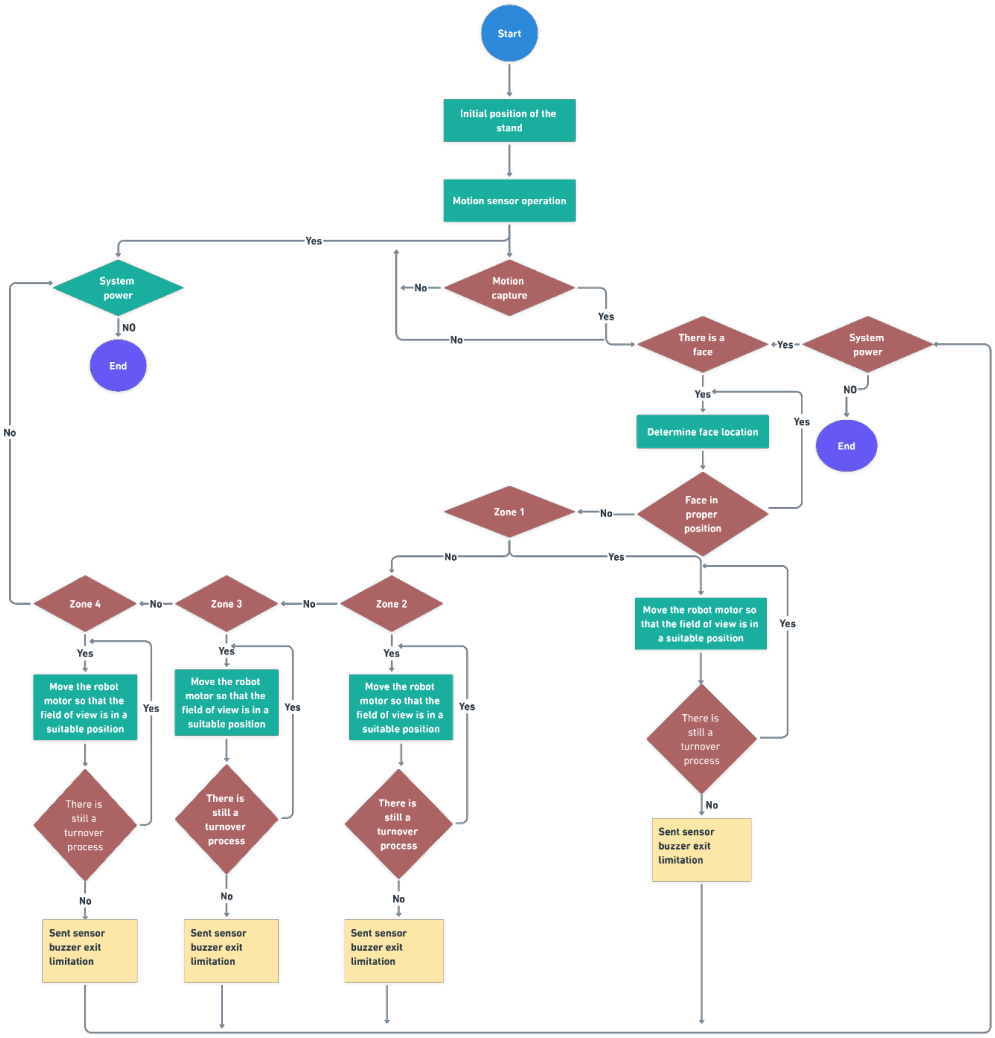

Figure 4. Working principle of the stand

3.5 Prototype

The prototype of the smart phone holder was successfully developed using a robotic arm and the HuskyLens AI camera as shown in Figure 5. The system was able to detect and track a human face and adjust the phone's position to maintain a comfortable viewing angle. Real-time tracking accuracy was acceptable under normal lighting conditions.

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Figure 5. Prototype of the smart phone holder

4. Results and Discussion

4.1 Testing

The system was tested in controlled indoor environments. Unit tests were conducted for the servo motor movement, camera face detection, and response timing. It was tested on more than one side (right, left, front and back) and it worked well. Functional testing confirmed the system could follow head movements within a range .
Watch the project implementation video, just swipe the QR code in Camera as in Figure 6 and Figure 7 or click here

Figure 6. Test Video

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Figure 7. Test the smart phone holder

4.2 Evaluation and Validation

Ten healthy male adults with mean age 22.38(SD 3.13) years were recruited. All participants were right-handed and utilized their cellphones for a minimum of 2 hours every day. Participants had no recent history (within the last 7 days) of trauma or musculoskeletal problems in the cervical and upper limb regions. Prior to the experiment, each participant was randomly allocated into 2 different conditions, smart stand use and traditional stand (Figure 8), utilizing basic randomization to mitigate possible systematic bias arising from the sequence of experiments. All individuals experienced both situations on different days. Body discomfort rate usability, user experience was collected for each participant after 30 min of Chatting - - watching video, Web surfing on a smartphone. The numeric rating scale (NRS) for neck and shoulder discomfort was assessed every 10 minutes from the commencement of testing. A minimum rest period of 24 hours was allocated between experiments to mitigate residual tiredness. Participants were instructed to vocally assess their degrees of shoulder and neck discomfort while remaining still. An NRS including 11 points was utilized, with 0 indicating no discomfort and 10 signifying considerable discomfort.

Figure 8. Smart phone stand and the traditional stand

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4.2.1 Neck and shoulder discomfort score

Significant changes in neck and shoulder discomfort levels were seen at all time intervals (p-value < 0.001) when comparing the two stands, except prior to the testing period, as illustrated in Figure 9. The conventional stance exhibited markedly elevated neck and shoulder discomfort scores compared to the smart stand condition. Both conditions demonstrated a marked rise in neck and shoulder pain ratings with prolonged smartphone usage.

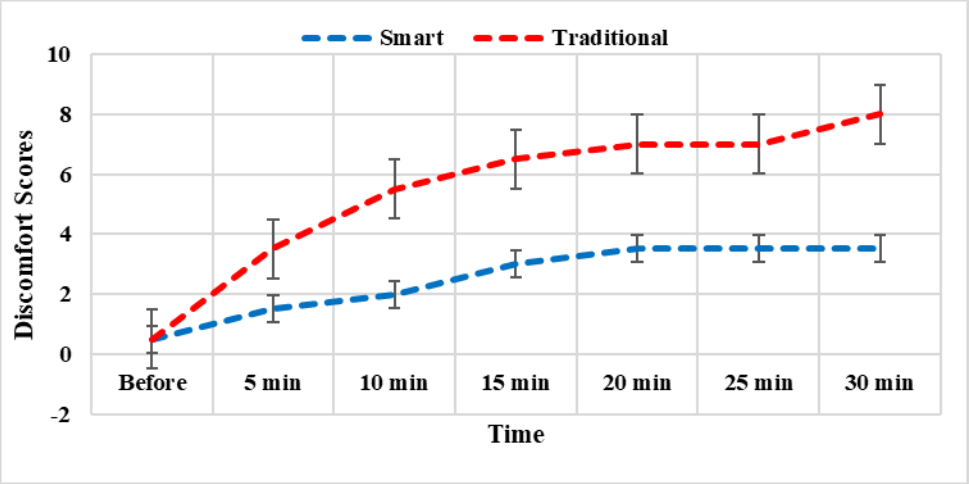

Figure 9. User neck and shoulder discomfort for Smart phone stand and the traditional stand

4.2.2 User Experience

User experience has been evaluated using the user experience questionnaire (Hinderks et al., 2018). Participants may evaluate each item using a 7-point Likert scale. The responses are rated from -3 (complete agreement with the negative statement) to +3 (complete agreement with the positive statement). Fifty percent of the things commence with a positive phrase, while the remaining items begin with a negative term, arranged in a randomized sequence. The 26 things are categorized into 6 scales:

- Attractiveness: Describes the overall impression of the product. Do users like or dislike it? Is it attractive, enjoyable or pleasing?
- Perspicuity: Describes how easy it is to get familiar with the product Is it easy to learn? Is the product easy to understand and unambiguous?
- Efficiency: Can users solve their tasks without unnecessary effort? Is the interaction efficient and fast? Does the product react quickly to user input?
- Dependability: Does the user feel in control of the interaction? Can he or she predict the systems behaviour? Does the user feel confident when working with the product?
- Stimulation: Is it exciting and motivating to use the product? Is it enjoyable to use?
- Novelty: Is the product innovative and creative? Does it capture the users attention?

Figure 10 to Figure 11 represents the result of the benchmarking; in all six categories instruction ranks over average (i.e., top 10%).

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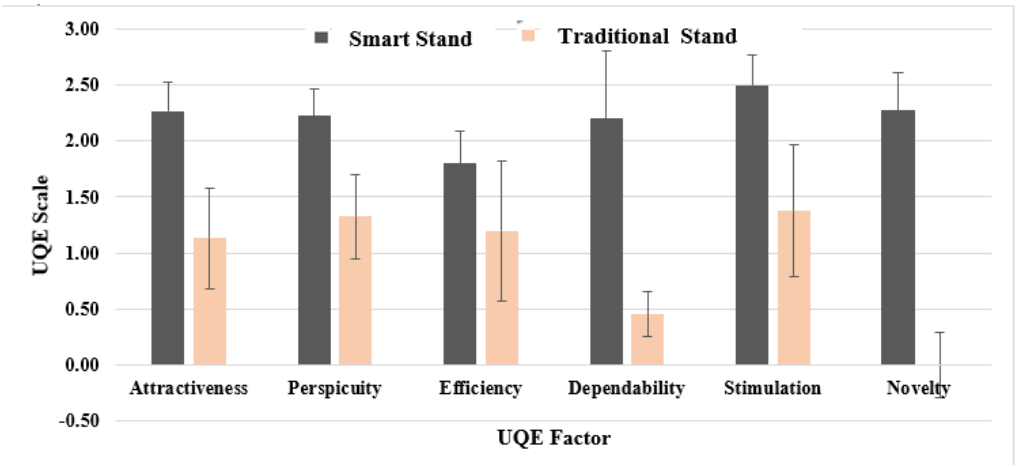

Figure 10. User Experience for Smart phone stand and the traditional stand

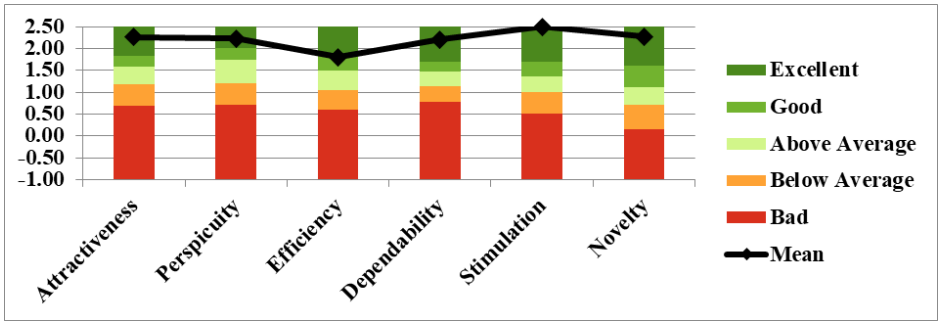

Figure 11. User experience of smart stand compared to benchmark

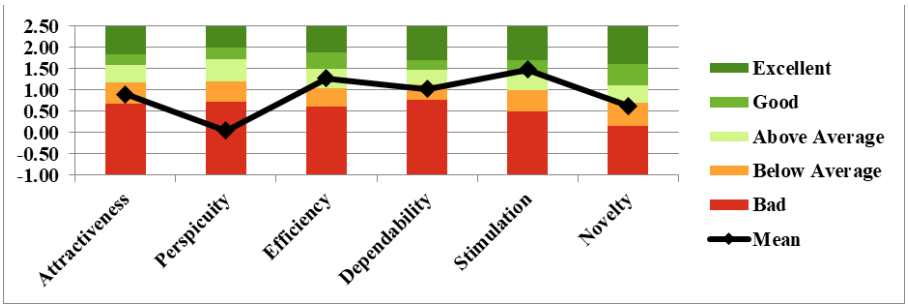

Figure 12. User experience of traditional Stand compared to benchmark

The smart stand demonstrates a practical and low-cost solution for improving smartphone usability in video calls or content viewing. The integration of face detection with motor control was effective. However, performance may decrease in low-light conditions or when faces are partially obstructed. Further tuning of the camera sensitivity and servo response can enhance accuracy (Figure 12).

5. Conclusion and Future Work

The study has successfully developed a smart system for tablets and mobile phones using artificial intelligence to enhance public assistance and safety. It effectively introduces the study's concepts, addresses existing problems, and outlines motivations, supported by a comprehensive literature review of current methods aimed at preventing smartphone disorders. Despite the variety of existing methods, none adequately met the diverse needs of all users. Our solution includes a smart camera on a stand designed to track movement, providing benefits to the entire community. By utilizing technologies such as Facial Recognition Software, husky lens, this system marks a significant

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advancement in the integration of AI into everyday technology. Focusing on user comfort and accessibility, the project has transformed interactions with devices. Its ergonomic design and intelligent features enhance the user experience, making it safer and more convenient for various groups, thereby improving overall quality of life. The designed smart stand found to keep the phone correctly at eye level, and at a comfortable distance and helps to keep cervical spine in high neutral position. In addition, the system minimizes the arms floating in front of the body. This tends to engage shoulder muscles can engage the neck muscles. Moreover, keep user back straight, shoulders relaxed, and avoid leaning forward. The findings of this study showed that participants who use Smart stand led to enhance user performance, reduce neck and shoulder discomfort as compared to traditional stand. The SUS indicates unfavorable evaluations for the traditional stand regarding both perceived utility and perceived ease of use. The smart stand was seen as highly beneficial and user-friendly. The smart stand automatically adjusts the optimal height of the stand to eye center and the distance between the user and the device, ensuring maximum comfort and reducing physical strain, particularly on the neck. The smartphone stand greatly enhanced the quality of life.

For strengthen the findings, future study should use a faster microcontroller to enhance the AI-powered smart stand system in order to obtain the angles more quickly and in smoother movement. Additionally, a longer-term study to assess the stand's effectiveness should be done with large and different groups of participants such as elderly, children, and individuals with disabilities. Moreover, future experiments should evaluate smart stand using objective measures, such as electromyography (EMG), electrocardiogram (ECG), to measure neck, shoulder, and back muscle activity, as well as user visual fatigue.

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