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Smart Adaptive Machine Learning Based Laptop Stand (Workbit)

Reetu Jain, Shekhar Jain, Pratham Papneja, Atharva Nihalani, Nischal Patel, Radha Krishna
On My Own Technology
Mumbai, MH, India

***Abstract* -White-collar workers who sit at desks all day face different risks than a delivery driver who wrangles boxes all day. Sitting in the same position working at a computer terminal which can increase the potential for herniated discs. Office workers also suffer from poor posture, tending to slump their shoulders inward as they sit and type, which can lead to muscle atrophy and increased strain on musculoskeletal joints. To prevent this, we have created an intelligent stand called "WorkBit" objective is to provide an interactive work health trainer on every desk that can monitor your daily work health and help you take preventive measure such that, person productivity increases, overall wellness increases, less stress, improved posture, less strain on the eyes, improved sleep patterns thus maintaining "WORK HEALTH BALANCE". Our proposed solution is a highly sophisticated laptop stand mounted on wheels. It detects how far away the user's face is from the laptop and can accordingly move in the four directions on the plane it rests on. It can even raise the laptop by 12 cm thus if the user's table is too short, the laptop can still be raised to eye-level to avoid putting a strain on the neck.**

***Keywords*- Machine Learning, Python, Arduino, Open CV, Face Detection.**

I. INTRODUCTION

Posture is simply the position our bodies adapt in response to the effects of gravity. It is the way we hold ourselves, in sitting, standing or even lying down. No single posture allows us to carry out everything we want to do, and we adopt many different postures in order to do different tasks. 'Good' posture allows us to move in the way we want, causing our bodies the least amount of strain and damage. White-collar workers who sit at desks all day face different risks than a delivery driver who wrangles boxes all day. Sitting in the same position - working at a computer terminal, for example - puts a great amount of compressive force and sustained pressure on the lower lumbar spine, which can increase the potential for herniated discs. Office workers also suffer from poor posture, tending to slump their shoulders inward as they sit and type, which can lead to muscle atrophy and increased strain on musculoskeletal joints, preventing back pain is a major workplace safety challenge.

"Digital health strain" is now a serious condition, over the past 20 years; the exposure and dependence on computers have risen on average from 20% to 85% in most work fields. Paperless offices with automation have made computer devices an integral part of their work life. Varied devices like desktops, laptops, and tablets differ in screen size, keypad size, and navigation methods. As screen time increases in office - so do the problems like blurred vision, burning eyes, backaches, neck strain, headaches and disrupted sleep. Actions such as prolonged Staring into the computer, a strained, static posture, and typing for long periods of time put a strain on a range of body parts such as the back, neck, and wrist.Our model has numerous features that help combat bad posture. Firstly, it can discern whether the user is slouching or not by detecting the position of one's face with regards to the laptop's webcam. If one's posture is improper, then WorkBit will travel in the opposite direction as the user, thus making him return to his original posture (i.e. if one is slouching, WorkBit will move towards the person, forcing him to move back).

Additionally, WorkBit keeps track of one's blink rate and can notify the user via a pop-up GUI to blink more if it falls below a certain limit. It can also control the screen brightness which is linked to one's blink rate. This prevents fatigue and keeps dry eyes at bay. The GUI also contains handy information about how long one has been slouching for, and how long one has been using the laptop at a stretch. It also displays prompts every hour, telling the user to take a short break. All the daily data regarding one's work health is uploaded to a server on the cloud to keep track of one's health.

This can be shared with your doctor, and one can take corrective actions to it counts your number of blinks and helps you to keep average to 24 blinks per minute, this helps in the reduction of digital eye strain and blurred vision caused due to constant staring at the screen. Finally, all the daily data regarding your work health is uploaded on the cloud to keep daily analysis of health.

This can be downloaded and shared with your doctor, thus benefiting medical health.

1. Cervical Pain

Cervical pain involves changes in the bones, discs or joints that are connected to the neck. The main causes of neck pain are cartilage and bone wear and therefore often occur in the elderly. However, this can also be due to other factors and it can also occur in younger adults. Some of the top causes of cervical pain are:

- Overuse of the neck – some people's everyday work involves tedious movements that put pressure on the spine, resulting in easy wear and tear. This does not have to involve just physical work like heavy lifting, but also desk jobs where posture can be a problem.
- Injury – an injury in your neck or spine region is an instant aggregator for cervical pain.
- Herniated discs – this kind of cervical pain occurs when spinal discs develop cracks in them. These cracks give way to leakage of the internal cushioning material which can in result, pressurize the spinal nerves and cords. Cervical pain symptoms caused due to this can bring numbness and pain in the arms.
- Dehydrated spinal discs – the discs between your spine can dry out at times and thus the rubbing of them can cause chronic cervical pain.
- Bone spurs – this cervical pain is caused due to the overgrowth of a bone that can press against other the spinal nerves and spinal cord and get painful.

In addition to these causes, there may be other regular bad body postures. This may be due to bad seating arrangements, improper mattress structures and more.

2. Back Problems

Sitting in front of your computer for hours at a time strains your neck and back. You lean forward and extend your neck toward the screen, pulling your torso out in front of your hips instead of keeping it stacked up straight to support your weight. Your shoulders rise as you type on your keyboard and your shoulders to tighten. Sitting in an office chair for prolonged periods of time can cause low back pain or worsen an existing back problem. The main reason behind this is that sitting in an office chair or in general, is a static posture that increases stress in the back, shoulders, arms, and legs, and, can add large amounts of pressure to the back muscles and spinal discs.

Back and neck pain, headaches, and shoulder and arm pain are common computer-related injuries. Such muscle and joint problems can be caused or made worse by poor desk design, bad posture and sitting for long periods of time. Although sitting requires less muscular effort than standing, it still causes physical fatigue and you need to hold parts of your body steady for long periods of time. This reduces circulation of blood to your muscles, bones, tendons and ligaments, sometimes leading to stiffness and pain. If a workstation is not set up properly, these steady positions can put even greater stress on your muscles and joints.

3. Carpal Tunnel Syndrome

Carpal tunnel syndrome is a common condition that causes pain, numbness, and tingling in the hand and arm. The condition occurs when one of the major nerves to the hand — the median nerve — is squeezed or compressed as it travels through the wrist. In most patients, carpal tunnel syndrome gets worse over time, so early diagnosis and treatment are important. Early on, symptoms can often be relieved with simple measures like wearing a wrist splint or avoiding certain activities. If pressure on the median nerve continues, however, it can lead to nerve damage and worsening symptoms. To prevent permanent damage, surgery to take pressure off the median nerve may be recommended for some patients.

4. **Myopia**

A new research mentioned in the American Academy of Ophthalmology journal, suggest that part of the global rise of myopia can be attributed to near work activities. Myopia or near-sightedness is a refractive error. It is an eye focusing disorder, not an eye disease. Generally, can be inherited. Nowadays artificial Myopia is becoming common in children between ages 8 and 12 years old. Artificial Myopia is the new age Myopia arising out of Computer / Digital Exposure. During their teenage years, when the body grows rapidly, continuous digital exposure may cause myopia to become worse. Between the ages of 20 - 40, there is usually little change. Artificial Myopia can also occur in adults. People with myopia have a higher risk of developing a detached retina.

Some of the signs and symptoms of myopia include:

1. Eyestrain,
2. Headaches,
3. Squinting to see properly, and
4. Difficulty seeing objects far away, such as road signs or a blackboard at school.

These symptoms may become more obvious when children are between ages 8 and 12 years old.

1. Statistics for Digital Lifestyle Affecting Your Health

According to various studies, computer usage is linked with a reduced occurrence of blinking and an increased frequency of tear evaporation, and individually each of these leads to dry eyes. Others indicate that several aspects of posture are significant because the individual is required to maintain the same position for prolonged durations. "Muscles are often held in static, awkward, or extreme positions." Further, researchers point out that "the head may be tilted, the arms abducted and unsupported, shoulders elevated, and wrists flexed and deviated from a neutral position". "Frequent computer use is associated with an increase in musculoskeletal complaints of the neck/shoulder region as well as of the hands and arms.

The outcomes of the current research for visual and musculoskeletal health complications are persistent with the research done by. Our study revealed that 29.2% participants experienced headache, which is in keeping with an earlier study conducted by Bhatt. Although several people working at a 5-computer encounter eye-related distress and/or visual issues based on existing evidence it is incongruous that the use of computers causes perpetual variations or harm to the eyes or visual system.

Research has proved that most computer workers come across some eye or vision problem. Nevertheless, it is indistinct whether these issues are present to a larger magnitude in computer users than in workforces in other highly visually challenging works. In a national assessment of Doctor of Optometry, it was found that more than 14% of their patients approach them with eye or vision-related indication sensing from computer work. they observed that the most common indications are eyestrain, blurred vision, headaches, and neck or shoulder pain.

2. Problem Identification (Problems Due To Bad Sitting Postures)

For many reasons, including perceived financial costs, some employers remain reluctant to implement preventive measures. However, research suggests that a more proactive approach provides a greater return on investment for the employer. When employees are healthy and happy, they're more productive. We identified that back and neck pain, headaches, and shoulder and arm pain are common computer-related injuries. Such muscle and joint problems can be caused or made worse by poor desk design, bad posture and sitting for long periods of time.

Although sitting requires less muscular effort than standing, it still causes physical fatigue and requires you to hold parts of your body steady for long periods of time. This reduces the circulation of blood to your muscles, bones, tendons and ligaments, sometimes leading to stiffness and pain. If a workstation is not set up properly, these static positions can put even greater stress on your muscles and joints. The people in the age group of 16-34 years make up about 20% of back and neck treatments in India. This shows that the younger generation of people too are being affected by back and neck problems which strikes the possibility that white-collar jobs (the group of jobs that are rising in India) have an adverse effect on the well-being of the younger generation.

II. LITERATURE REVIEW

The lumbar spine, thoracic bones, and the cervical spine are affected by wrong posture while working. Even teenagers experience back pain as one of the effects of bad posture, such as when they slouch in front of the computer. Over time, poor posture can lead to a loss of function and even deformity in the spine. Body Pain. The stress of bad posture doesn't just hurt your back. Five vertebrae make up the lumbar spine, which provides support for much of the upper body. The third lumbar spine vertebrae (L3) is in the middle of the lumbar spine and is prone to wear and tear. Common problems associated with it are ligament and muscle strain, and additionally, it is one of the most common sites for chronic lower back pain.

The disc pressure on L3 is considerably higher during unsupported sitting positions than in standing, and it is this pressure that might cause disc degeneration, which results in complications in one's old age. However, this lumbar pressure decreases significantly in supported sitting positions. Support such as having a back inclination, or using armrests are found to help the most.This study has found that sitting more has been associated with more neck and back pain, however, this only takes blue collar jobs into account. The results may be different for white collar workers, as blue-collar jobs require a lot of physical exertion, and one's posture while sitting at a computer (white collar jobs) is different than one's posture while sitting. Some other studies on the subject show inconsistent and even conflicting conclusions.

Another study says that when one is sitting for most of the day (such as most office workers) poor posture could lead to a slew of chronic, long-term ailments. Sitting in an unsupported position on conventional seats often leads to the loss of the natural "lordosis of the lumbar spine". This can also cause the "overstressing of the discs, ligaments and muscles". WorkBit combats this by elevating the laptop, prompting the user to sit upright, thus restoring some of the lordosisAnother study has shown that a slight incline of the desk (around 12 degrees) while using a computer with "internal input devices" - i.e. a laptop - gives the users the least discomfort, while "improving head and neck postures".

While working at a laptop, the range of postures are limited. This is because the screen is connected to the keyboard and they can't be separated - unlike the desktop computer. This results in constrained body postures and movements. This ergonomic disadvantage has resulted in "greater neck flexion and head tilt" (however, the self-reported user discomfort wasn't significantly greater while using laptops). Higher neck flexion has been observed to increase "biomechanical load on surrounding structures" and "the [possible] development of musculoskeletal disorders. Another study showed that "screen height strongly influenced neck flexion", with higher screens, reducing flexion. When one uses WorkBit, the screen height autonomously adjusts itself to the optimal height for the user, thus reducing flexion.

The study has also found a high correlation between longer working hours and the level of pain reported. All this means that laptops should be used for shorter periods of time along with frequent breaks and proper ergonomics, while there can be more leniency with desktop computers.

1. Current Solutions for Different Problems

1.1 Stands:

Ergonomic chairs provide support and reduce the strain on the lumbar back. Offices should be advised to buy these chairs. They should also invest in adjustable footrests. There are a variety of laptop stands in the market already. Some of them are simple stands that just tilt the laptop at an angle while others are more complex mechanical ones that can move the laptop up and down as, the advantage of the simple stand is that the slight angle reduces the screen glare and makes it more comfortable to type with and reduces discomfort. Complex stands can raise the laptop to eye level (if the surface is low), and this can help reduce eyestrain and pain in the neck from bending over. It also prevents slouching over the screen, and one can raise the keyboard to ideal height while typing so it won't put pressure on the spine/neck. Another advantage to this stand is that the elevated height leads to a greater circulation of air under the laptop, which reduces the risk of overheating.

Fig.1. Laptop stands available in market.

Fig.2. Desktop stands available in market.

These two are the main designs for laptop stands, however, there are some minor variants which include inbuilt fans for cooling; foldable stands for traveling; and a phone/cup holder for convenience. We have designed our stand to sense whether the ergonomics are optimized, using face detection software. Upon receiving this information, it can automatically adjust the laptop's height/tilt/position/screen brightness using motors. This makes is so that the user experiences the least strain on his back, neck, wrist and eyes.

1. Posture Corrector Belts:

Fig.3. Posture correction belt.

Posture correctors are a range of devices used to strengthen muscles in the lower and upper back, making it easier to stand up straight. They work by pushing your shoulders back so that your spine is aligned with your pelvis. Supporting design helps correct bad body posture of the back and shoulders. A posture corrector belt provides gentle back support, and prevents a hunched back

2. Blue Light Filters:

Filter screens and glasses can be used to reduce the strain on eyes. One can also use applications/software (such as night shift) to reduce eye strain.

Fig.4.Blue light filter screen for laptop.

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4. Recommended Correct Posture for Long Sitting Hours

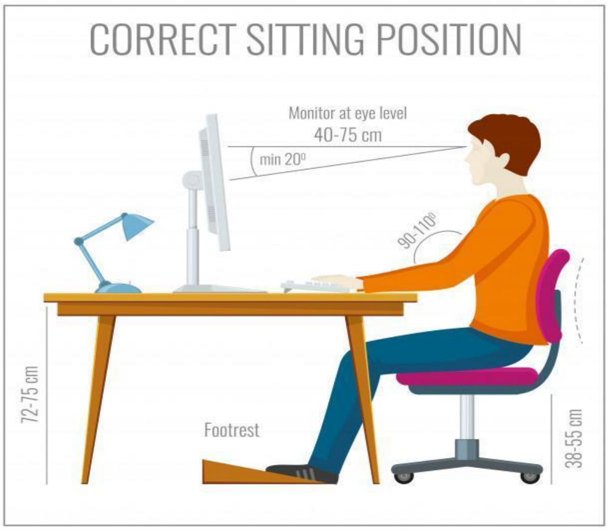

Fig .5. Correct sitting posture while working at a computer.

Guidelines for correct computer posture:

1. The top of your computer screen should be level with your eyes.
2. Your feet and knees should be hip distance apart and facing forwards. Your thighs should be slightly lower than your hips.
3. Your tailbone (at the base of your back) should be lifted.
4. Your shoulder blades should be held downwards slightly, allowing for length in the neck.
5. Your head should be directly over your shoulders. To help with sustaining this position, try imagining a helium balloon arising from the top of your head lifting you upwards.

This is the posture you should maintain while sitting at a desk looking at a computer. You should then ensure that your desk, chair and computer are set up ergonomically to support this position.

4.1 Problems with Current Solutions:

1. Many current laptop stands aren't adjustable at all! Those that are adjustable need to be manually calibrated by the user. This is an inconvenience since the user will waste his time setting it up every time he starts work. He might even calibrate it wrongly without knowing it, thus making the stand useless.
2. Frequent adjustment of the laptop stand every time the user takes a break can be annoying for the user. One may also inadvertently slip into an incorrect posture, once again rendering the stand useless.
3. If one uses a posture brace for a longer period, it might lead the supportive muscles towards atrophy due to disuse. Over time, one will end up dependent on the brace. Furthermore, due to atrophy, one is at a higher risk of injury.
4. Usually, posture braces (correction belts) absorb the stress from your spine. However, in some cases, it simply shifts the stress to another area of the user's body. Consequently, this process may cause other muscle or ligament groups to become injured.
5. In some cases, if the brace isn't properly calibrated with your body, it may inadvertently lead to a serious injury.
6. Physical laptop blue light filters are often expensive.

2. Project Objective

An average person spends 1/3rdof his/her life in office, for a desk jockey more than 90% of this time is spent on desk working on a laptop, which is at the root cause of all health problems. Our objective is to provide an interactive work health trainer on every desk that can monitor your daily health and help you take preventive measure such that,

- person productivity increases
- overall wellness increases
- less stress
- improved posture
- less strain on eyes
- improved sleep patterns

4.2 Our Solution:

To overcome the disadvantages of the available solutions, the stand had to be actively adjusting to the changes in the posture of the user. Hence the wheels rack & pinion mechanism, and the Lego attachment were incorporated. To continuously detect the posture of the user without any external attachment, we designed a program for posture detection. This program can accurately detect the posture even with 0.5 MP camera; hence this can work smoothly even with low-end laptops.

The details of the mechanical design, electronics, and the software system are explained in the following section.

5. Mechanical Design:

Our proposed solution is a highly sophisticated laptop stand mounted on wheels. It detects how far away the user's face is from the laptop and can accordingly move in the four directions on the plane it rests on. It can raise the laptop by up to 12 cm if the user's table is too low, making it possible to raise the laptop to eye-level to avoid putting any strain on the neck. Another feature of our stand is that it has a blink detection algorithm which measures how much the user blinks in one minute. The optimal blink rate (to avoid dry eyes and irritation) is 22-24 blinks per minute. Since factors such as the ambient light and the screen brightness affect the number of blinks per minute, if the user isn't blinking enough, our software can autonomously adjust the computer's brightness, passively regulating the user's blink rate.

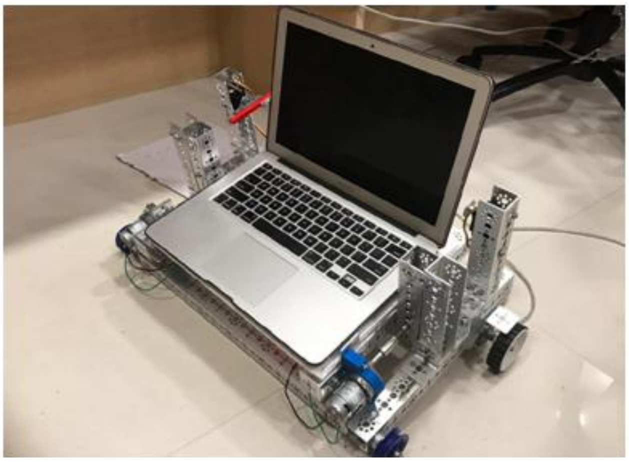

Fig .6. The Working Model.

We placed ultrasonic sensors on the sides as well, so the stand wouldn't fall off the table while moving. Additionally, we finished the connecting and placing electronics along with all the wiring of the motors and servos. Our final design has various unique features and a range of mechanisms to improve its usability.

6.1 Wheels: Our model has 2 pairs of wheels, out of which only 1 pair is connected to a motor. This is to reduce the amount of wiring and to make the design less bulky. The forward pair of wheels are shorter than the ones behind, the purpose of this being to tilt our stand forward at an angle to reduce strain on the wrists. The wheels were specifically chosen so that the angle of the tilt formed was the recommended 12 degrees.

6.2 Rack and Pinion mechanism: This mechanism is used to move the laptop upwards and downwards. This went through a couple of iterations as it tended to make the design bulky and cramped to type on. In the second-to-last iteration, the rack and pinion were in the middle of the bot and the motors + motor mounts were very inconveniently placed. Thus, we moved the bulk of the robot to the back end. We also added gears to transmit the motion from the motor to the pinion, eliminating the need for axle connectors.

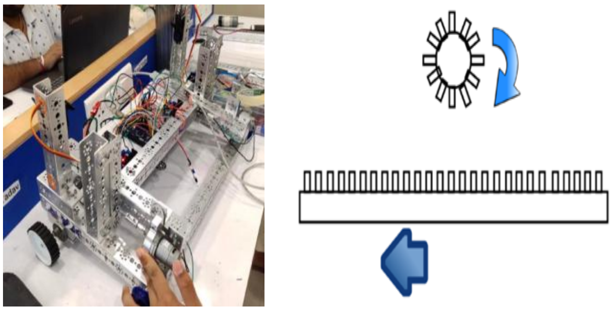

Fig .7. The Rack and Pin Mechanism.

Right is a pictorial demonstration of how a rack and pinion system works. The pinion gear meshes with the rack so that when it turns, the rack moves in a horizontal direction. This is an example of converting circular motion to lateral motion. A motor is connected to the pinion gear via an axle, and when it turns, the rack moves either forwards or backwards.

6.3 Servo motors with Lego attachment (pic below): We have attached two servo motors on top of the extending rack and pinion mechanism. On this, we have added an attachment made of Lego, whose purpose is to adjust the tilt of the laptop screen. It's quite simple, yet effective.

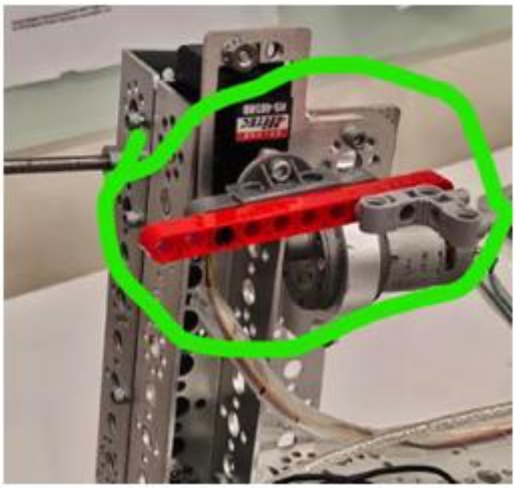

Fig .8. The tilting of Screen Mechanism.

6.4 Sensors: We have used 2 sensors, one infrared sensor and one ultrasonic sensor. The purpose of the ultrasonic sensor is to detect if the robot is at the edge of the table so that it doesn't accidentally fall off. The purpose of the infrared sensor is to detect the presence of a person so that the robot doesn't accidentally keep running after the user has left.

6.5 Calculating the tilt

We calculated the inclination of the keyboard to be about 12 degrees using trigonometry. The math used for this is below, with the diagrams as a visual aid. We need to find sin theta (marked x). This is equal to opposite upon hypotenuse => it's equal to 5.8/28.7 ~ 0.2021. Then we found the $\sin^{-1}$ of 0.2021 which is equal to 11.71 degrees. This angle has been found to put the least strain on the wrists and is found to be the most comfortable position while typing.

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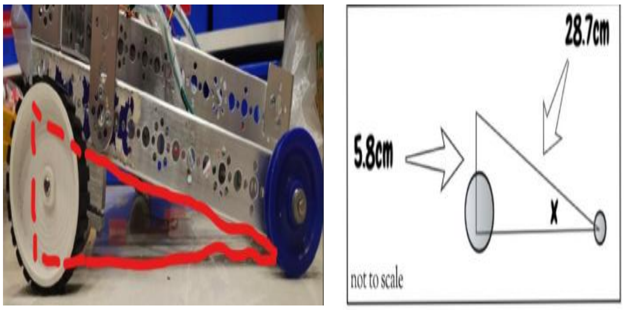

Fig .9. The Height Mechanism

7. Electronics and Software Methodology:

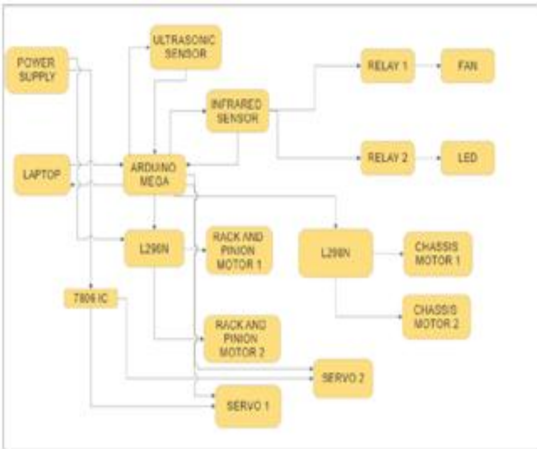

Fig .10. The Flowchart for Electronics Circuit

In our system, the Arduino Mega is used as the controller for the movement of the different mechanisms. The Arduino is communicating with the laptop via serial communication. We have used two motor drivers (L298N). One is to control the raising and lowering of laptop pad and the other is used to control the forward and backward motion. A PWM (Pulse width Modulation) signal controls the speed of motors through the driver and digital pins are used to change the direction of the motors.

An ultrasonic sensor is used to detect the edge of the table so that the prototype does not fall off the table. The relays are connected to the infrared sensor, which is used to detect the presence of a person, which in turn sends a signal to control the light and fan (if the presence of a person isn't detected, Work Bit can turn off power-consuming devices at the workstation such as lights/fans/air-conditioners to reduce energy wastage). Servos are used to control the tilt of the screen so that it matches your eye level. An IC7806C (voltage regulator) is used to get the regulated voltage of 6V for the servos and the relays. A Li-Po battery of 12V is used to power Work Bit. The machine learning algorithm we used is a "Convolutional Neural Network (ConvNet/CNN)". This is a Deep Learning algorithm which can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. While in primitive methods filters are hand-engineered, with enough training, ConvNets can learn these filters/characteristics. The architecture of a ConvNet is analogous to that of the connectivity pattern of Neurons in the Human Brain and was inspired by the organization of the Visual Cortex. Individual neurons respond to stimuli only in a restricted region of the visual field known as the Receptive Field. A collection of such fields overlaps to cover the entire visual area.

An image is nothing but a matrix of pixel values, right? So why not just flatten the image (e.g. 3x3 image matrixes into a 9x1 vector) and feed it to a Multi-Level Perceptron for classification purposes. In cases of extremely basic binary images, the method might show an average precision score while performing prediction of classes but would have little to no accuracy when it comes to complex images having pixel dependencies throughout.

A ConvNet can successfully capture the Spatial characteristics in an image through the application of relevant filters. The architecture performs a better fitting to the image dataset due to the reduction in the number of parameters involved and reusability of weights. In other words, the network can be trained to understand the sophistication of the image better.

8. Steps that go through this CNN:

Input Image - In the figure, we have an RGB image which has been separated by its three color planes (Red, Green, and Blue). The role of the CNN is to reduce the images into a form which is easier to process, without losing features which are critical for getting a good prediction. This is important when we are to design an architecture which is not only good at learning features but also is scalable to massive datasets.

Convolution Layer (The Kernel) - Convoluting a 5x5x1 image with a 3x3x1 kernel to get a 3x3x1 convolved feature

Image Dimensions = 5 (Height) x 5 (Breadth) x 1 (Number of channels, e.g. RGB)

In the above demonstration, the green section resembles our **5x5x1 input image, I**. The elements involved in carrying out the convolution operation in the first part of a Convolutional Layer are called the **Kernel/Filter, K**, represented in yellow.

8.1 Pooling Layer

Like the Convolutional Layer, the Pooling layer is responsible for reducing the spatial size of the Convolved Feature. This is to decrease the computational power

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required to process the data through dimensionality reduction. Furthermore, it is useful for **extracting dominant features** which are rotational and positional invariant, thus maintaining the process of effectively training of the model.
There are two types of Pooling: Max Pooling and Average Pooling. Max Pooling returns the maximum valuefrom the portion of the image covered by the Kernel. On the other hand, **Average Pooling** returns the average of all the values from the portion of the image covered by the Kernel.

Max Pooling also performs as a **Noise Suppressant**. It discards the noisy activations altogether and performs de-noising along with dimensionality reduction. On the other hand, Average Pooling simply performs dimensionality reduction as a noise suppressing mechanism. Hence, we can say that **Max Pooling performs a lot better than Average Pooling**. Depending on the complexities in the images, the number of such layers may be increased for capturing low level details even further, but at the cost of more computational power. After going through the above process, we have successfully enabled the model to understand the features. Moving on, we are going to flatten the final output and feed it to a regular Neural Network for classification purposes.
Libraries used for Face Detection, Blink Convolutional Neural Network and Computer Vision Processing:
1. OpenCV
2. Keras
3. Tensorflow
4. Caffe
5. Tkinter

8.2 Posture Maintaining Test:
1. Posture Tests: In order to calibrate the final robot itself, we had to measure the values of distance and y-axis positions that the program was detecting and what they corresponded to in real-time posture. For example, we found that 7 corresponded an initializing correct posture whereas 10 corresponded to a slouching position. We performed three trials for both distance versus posture and y-axis face position vs body position on the y-axis. Both tables are described below.

- Y-axis face position vs body position on the y-axis
- Distance versus Posture:

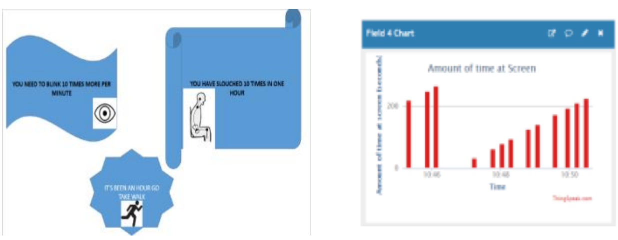

Fig .11. The Result Analysis

III. FUTURE SCOPE

This is just a working prototype that was created as a proof of concept. In the future, we plan to incorporate a wide array of features to our laptop stand. These features could potentially include, complete posture detection including forearm placement and customized posture calibration (for this we plan to add more data points such as a gyroscope/accelerometer); the autonomous adjustment of screen brightness in response to one's blink rate; cooling fans for the laptop; and the addition of a water bottle or a phone holder that can make this product appealing. Additionally, since we didn't have the budget to custom-design parts for this prototype, we had to make do with Tetrix components, which make our stand quite bulky and heavy. If this product is released in the market, we would use custom components for it (a viable alternative when mass-producing, as the cost is much less). This all would lead to the stand being much cheaper and compact.

IV. CONCLUSION

WORKBIT was tested on 20 employees of OMOTEC for over a period of 2 months following were the results found: Out of 20 employees, 7 had complaints about lower back problems which was attributed to bad sitting posture after a period of one month the test subjects seemed more alert regarding their sitting posture and lower back pain after 2 months reduced by almost 50%. Other 10 employees complained regarding strained eye vision with watery eyes due to continuous alerts on the screen the blink average of the test subjects increased from 9 blinks/min to 21 blinks/min within a month. Subjects were seen taking frequent breaks from screen time, there was a considerable reduction in head pain and watery eyes, remaining 3 employees were complaining of neck pain, frequent breaks from screen time to take a walk or stretching helped they overcome stiff neck problem.

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