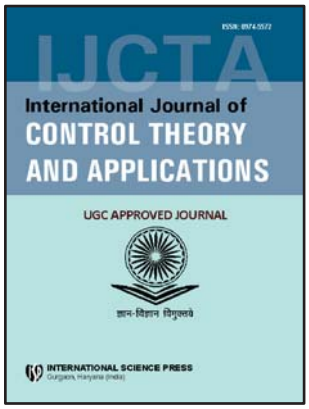

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All in One Smart Worktop

Anirudh Ganesh[a] Aishwarya Biju[a] Puja Dutta[a] and R. Sasikala[a]

[a]*Department of Electronics and Instrumentation, SRM University, Kattankulathur, Chennai - 603203*

E-mail: ag19952@gmail.com, aish.biju95@gmail.com, pujadutta3108@gmail.com, sasikala.r@ktr.srmuniv.ac.in

Abstract: The aim is to design and develop an ergonomic worktop (table) with smart functionality to cater to a variety of professional disciplines ranging from but not limited to IT, military, remote work locations etc. The modular worktop will provide seamless functionality by integrating features like smart notifications, health monitoring and efficient cooling for the PC/work-device while offering modular adaptability to future technologies thus bolstering our aim to redefine traditional workspaces. The need for such a design has been seen right from a time when there were a lot of job opportunities given to freshers especially in the field of information technology. The worktop is designed most specifically to provide ease and comfort to the people restricted to long hours of desk job. With further research and advancement into this project, it is also possible to incorporate other necessary features based on ones need. This involves providing aid to disable/ handicapped staffs at a workplace. The military field can also be benefited by features involving incoming data and alerts from remote operation locations (using the health monitoring system parameters on the worktop), which can hence be used to send necessary personnel to the location for providing aid. In other words, this all in one worktop can be is a thorough necessary / requirement in a number of professions. Apart from overall cost reduction, it also facilitates a better working environment provided by the various multinational companies to its employees. After all employee's work satisfaction is also a key aspect companies are looking to provide for. The need for charging a mobile phone/device is one of the many important needs of our everyday life. The presence of the wireless power delivery system on our worktop provides an opportunity to charge a device, as and when the person is working at the desk. Keeping in mind all the requirements of a desk job profession, we aim to make this worktop as efficient as possible. The introduction of such a worktop in the market will truly benefit many.

Keywords: *IoT; ergonomic; health monitoring system; wireless power delivery; smart notifications.*

1. INTRODUCTION

The predominant part of one's life is exhausted while catering to their profession. The common denominator among majority of the professions are the desk/table where each individual executes their tasks and we aim to transform this mundane desk into an advanced medium that optimizes and improves the work experience and in the near future is capable of being the only required work apparatus. The need for such an all in one worktop is seen in various industries as well. Studies show that in a typical working week, people spend on average five

hours and forty one minutes per day sitting at their desk and majority of them do not realize this fact. There are various fields like remote military application, ethical hacking, IT-stock algorithmic trading where individuals spend hours put together on the desk and without regard for their health end up with serious consequences. The presence of a health monitoring system on our worktop shows the effects of such long hours of work and this help is in taking preventive measures.

There are also statistics that show millions of dollars are wasted each year in regard with peripheral devices at the workplace. Chargers, cables, cup warmers, reminder pads etc. Thus by integrating multiple features into one worktop we have the ability to potentially save millions in manufacturing costs. The smart notifications can prove to be of much help to people who are in need of reminders. The touch panel (LCD Display) of the smart notification proves to be simple, easy to use and very efficient. Further, the existing can hence be modified to show other displays as well. This may include the presence of an online heart rate monitoring on the display (graphical). This will be linked to the health monitoring system on our worktop. Online research also shows us that 37 percent of desk workers are un-happy with their desk due to its stiff positions and lack of adjustability. Our worktop is designed to eliminate this problem related to lack of adjustability and incorporate features which improve the work environment.

This worktop mechanism/ design is such that it can take or with stand tension and other impact forces. The H frame base and the locking system of the height adjustable leg is yet another key feature of the worktop. Our research and survey had shown that a worktop with such a variety of facilities is currently not available for use at minimal cost. That is one of the many reasons as to why we decided to incorporate such a variety of features. The need for a good and healthy working is of major importance especially in recent times with the introduction of technology and other related companies. This worktop being light in weight, compact and completely capable of being dismantled will be of help to many. The constant health monitoring (using the heart rate sensor and the temperature sensor) on the worktop surface is capable of providing immediate alerts/alarms can help deploy emergency services to help the person in need.

In comparison with the existing worktop we found that a normal worktop is a piece of furniture with a flat top with usually 4 legs, provides a level surface for eating, writing, or working at offices. It has no special features but only provision for keeping some equipments or documents needed for the person to work. A normal table can be used for many purposes like school students use it as study table. This All in one worktop can however be used by people in the IT industry who work for long hours, etc. People who have to work for several hours at their desks face serious health problems which they remain ignorant about and therefore do not take any preventive steps.

So, to make the job easy for these people, the concept of a smart worktop is introduced. A smart worktop is a solid surface which is designed to contain advanced features in order to simplify desk jobs. A smart worktop can be used in several areas like offices, defence, etc. The features which this smart worktop can contain are wireless charging device, cooling medium, health monitoring facility, smart notifications, different adjustable positions, navigation maps, floor plans and many more.

2. CHARACTERISTICS

2.1. Health Monitoring System

The health monitoring system aims to observe heart rate and temperature parameters of the body. The sensors used are heart rate sensor and temperature sensor. The system consists of two probes which are placed on the worktop surface in order to get the health parameters from the finger tips of the individual when seated at the desk. The range of data about the normal health conditions of a human being are collected and stored in the cloud-based storage for online retrieval through the web screen. The data from the above mentioned sensors are collected and compared with the stored parameters to check whether there is any discrepancy in the

health conditions of the individual. This involves an alert /alarm mechanism to show any abnormalities in the measured health parameters. This is especially useful for senior citizens or people with some disabilities who may be left unsupervised for some time. The caretaker/family member can receive a notification or alarm in case of emergency.

2.2. Wireless Power Delivery

Wireless power delivery involves the process of transferring electrical energy by means of electromagnetic fields. The concept used in this project is inductive coupling between the two coils in close proximity. The AC power supply is given and the charging of the device begins once the two inductive coils are brought near each other. The basic idea is to charge a mobile phone which can later be improvised to charge other electronic devices as well. This mechanism of power delivery positioned on one corner of the worktop surface not only saves space but also reduces overall cost.

2.3. Cooling Medium

Studies have shown that when the temperature of the laptop reaches 35 degree Celsius (95 degrees Fahrenheit), the probability of its internal components getting damaged increases. The main reason for the laptop getting heated up is accumulation of dust on it. So, a cooling object should be present to control this over heating condition. Hence, this cooling set up aids to reduce the excessive temperature of the laptop. The worktop is designed to incorporate a couple of fans which provides the necessary cooling effect. This mechanism in our worktop keeps in check the temperature so as to prevent any hazard/accident as well. Constant temperature monitoring is of utmost importance to protect the laptop as well as other components on the worktop. This is thoroughly achieved by the cooling medium mechanism on the worktop surface.

2.4. Smart Notifications

Smart notification is a feature which allows one to get important information about the status of a system. These notifications will be highly useful in providing weather updates, reminders, etc. It comprises of Raspberry pi module along with a touch resistive LCD display. Note that only the display will be visible to the user the electronic components involved will be encased within the table/worktop.

2.5. Ergonomic Adjustability

The design of the worktop is such that it provides comfort and efficiency for the people who are required to sit at their desk for long hours in order to perform their tasks. The worktop is ergonomic because it allows various position adjustments. This is a solution for those people who complain about several hours of stiff positions at their workplace. The height of the table can be adjusted from 55 to 75cms, angular adjustments are possible and it can also be fully rotated. Both left and right handed users are comfortable to use this worktop. The additional locking mechanism in height adjustment is a key feature which helps fix the height. The table is portable as it can be fully dismantled for the purpose of easy transportation.

3. 3D DESIGN OF WORKTOP

The 3D design of our smart worktop is shown above. The H frame base is the key feature of our design. It provides the necessary support for the worktop which hence makes the worktop sturdier. The height adjustment consists of a locking mechanism which can be used to fix the necessary height based on the user's convenience. The worktop surface can be positioned such that it can be used by right or left handed persons with ease. The surface of the table consists of specific sections - health monitoring system, wireless power delivery system and the cooling medium. Note that all the electronic components are encased within the table structure thereby only showing the user specific hardware on its surface. The wireless power delivery, based on the method of

inductive coupling is such that it should facilitate the charging of a mobile phone of the user as and when he is working. The surface of the table consists of a final layer of wood, which is polished to make it neat and appealing. Apart from the overall cost reduction, the worktop is also compact .This makes it ideal as a product to be introduced into the market as well.

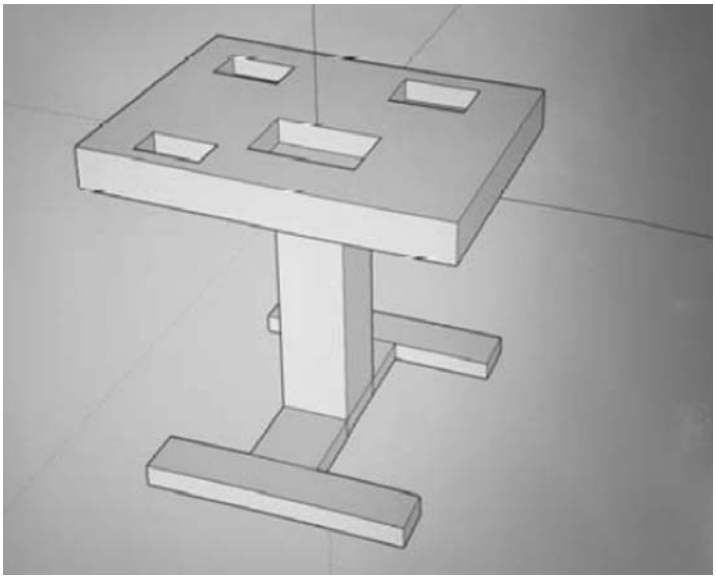

Figure 1: 3-dimensional Design of the Worktop

4. SYSTEM ARCHITECTURE

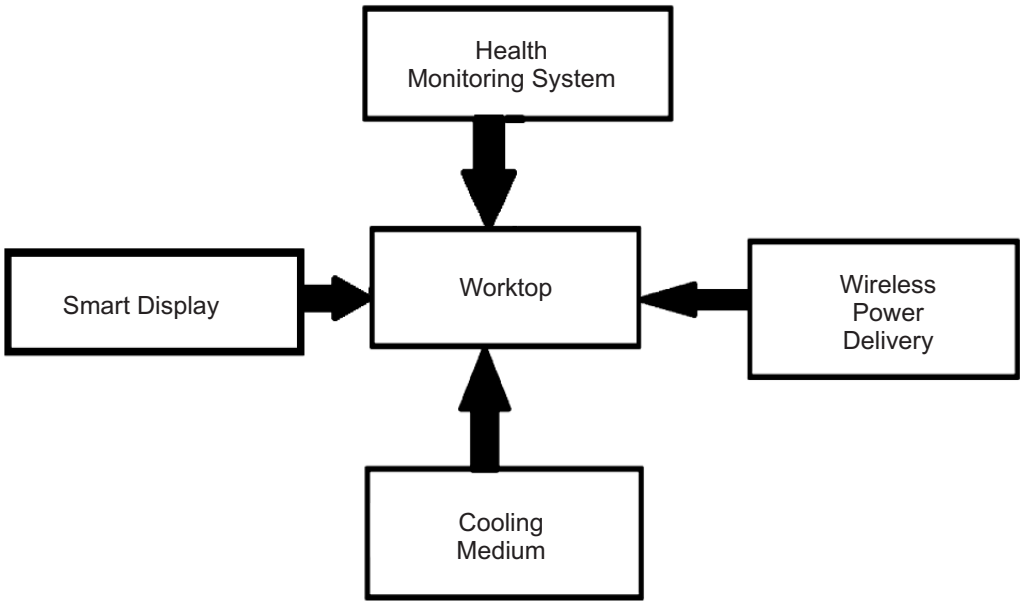

Figure 2: Block Diagram of the worktop

The worktop is designed to contain a health monitoring system, a smart display, a cooling medium and a wireless power delivery module.

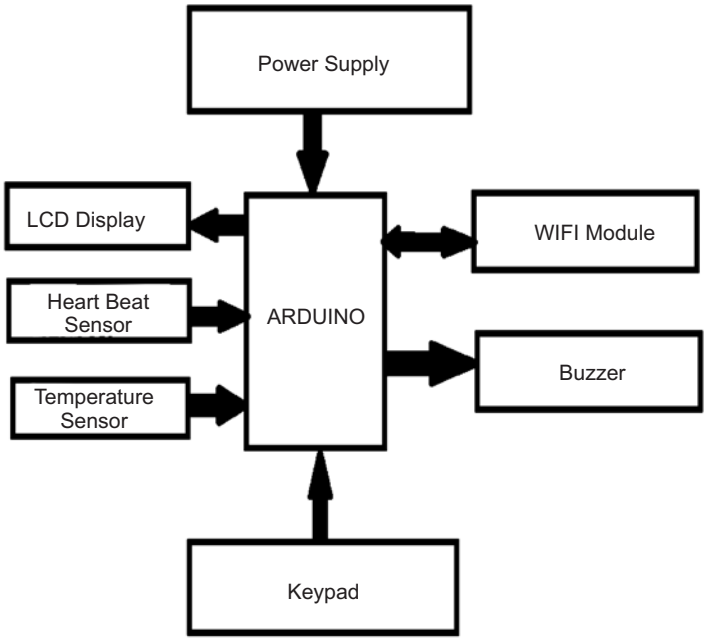

Figure 3: Block Diagram of the health monitoring system

The health monitoring system is based on Internet of Things. It contains heart beat sensor and temperature sensor to detect the body parameters of the person at the desk. There is a Wi-Fi module incorporated for online retrieval of data and a buzzer to give an alert in case of any discrepancy. The LCD display is included to show the data collected and the keypad is used to enter the range of normal parameters.

5. WORKING

The worktop is designed to accommodate various features which enhances the working conditions. The systems included in the worktop are the health monitoring system, the cooling medium, the wireless power delivery and the ergonomic design.

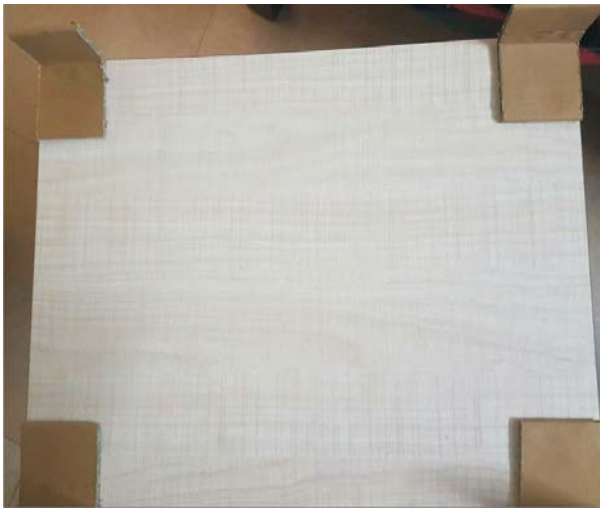

Figure 4: Worktop Surface (Top View)

The wireless power delivery is a portable power source used to charge a mobile phone. When the main AC supply is provided, the induction coils come in close proximity and the charging takes place through mutual induction. The production of an electromotive force in a circuit by a change in the current in an adjacent circuit which is linked to the first by the flux lines of a magnetic field is called mutual induction.

The cooling medium contains a couple of fans which rotates to provide the necessary cooling effect. 12V DC Fans used which are same as those used in computer systems. 2-Pin configuration is replaced with a direct 2-wire system and connected to a DC Power supply. Fans are positioned at an optimal angle to vent the heat produced by the computer system. It operates on a manual switching mechanism

The flexible adjustability of the worktop enables multiple positions based on the user's convenience.

Figure 5: The Height Adjustability

Figure 6: The H-Frame Base

The health monitoring system keeps track of the health parameters of the person sitting at the desk and helps in detecting any kind of abnormalities.[2] An IoT based patient health monitoring system is used to monitor the users health as he/she is working on the table. It currently monitors heart rate and temperature. A 8051 based micro-controller board is used and interfaced with ESP 8266 -01 Wi-Fi module for network access. [3] The heart rate and temperature data retrieved via a finger tip heart rate sensor and temperature thermistor are transferred to an online data base and based on set points controlled via the GUI on the open source IoT gecko network and thus allows visual, live monitoring of the health data. Thus the user's health can be monitored from anywhere in the world via a web page and the set points will help sound an alarm in case of emergency. The system also allows improved functionality with addition of more parameters and more modules.

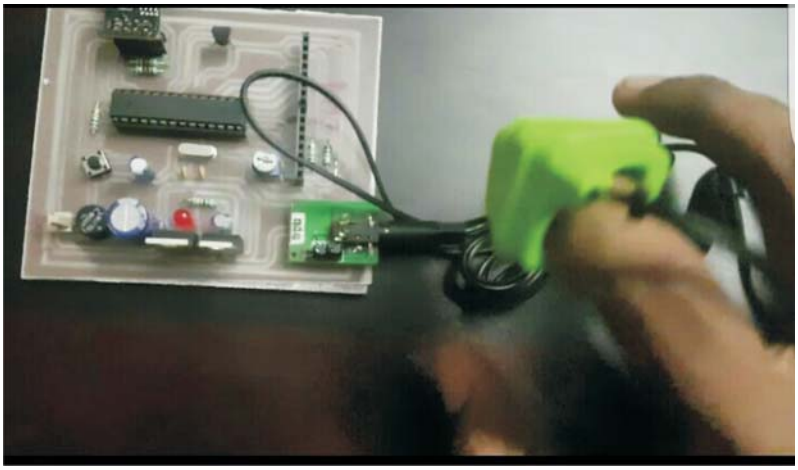

Figure 7: The Health Monitoring System

The smart display provides notifications and updates right on the table top, with added functionality of a GUI and minimal processing power. It is also able to establish network connection and perform web based tasks. It provides notifications like reminders, weather updates or any relevant data which is needed to display. A raspberry pi model B rev2 was used along with a 3.2 inch resistive LCD panel. The smart display was possible by flashing a custom GUI along with display drivers on the raspberry pi memory. The touch interface alleviates the need for KB/ pointer input mechanism and frees up 2 IO ports. The smart module can also act as a miniature computing/ communication mechanism when there is a lack of a computing device.

Figure 8: The Resistive LCD Display

6. RESULT

The key feature of this project is to enhance the working environment of the workers who have several hours of desk job. In order to show the various functions of the worktop we shall arrange a set up to measure the real heart rate and temperature by heart rate monitor and a clinical thermometer to verify whether the parameters shown are accurate. The productivity of the constructed worktop will be analyzed by providing the same to the real time work place and taking the feedback from the people who have tried using it. The ergonomic smart worktop is designed with multi- position adjustability including height and angle of inclination. The worktop is also equipped to monitor the health of the user by reading heart rate and temperature parameters. The work top can provide smart notification updates via a 3.5 inch resistive touch LCD display and can vent the heat of any computing device placed on it via cooling fans .All of these features in a single working apparatus is an important part in showing the success of this project.

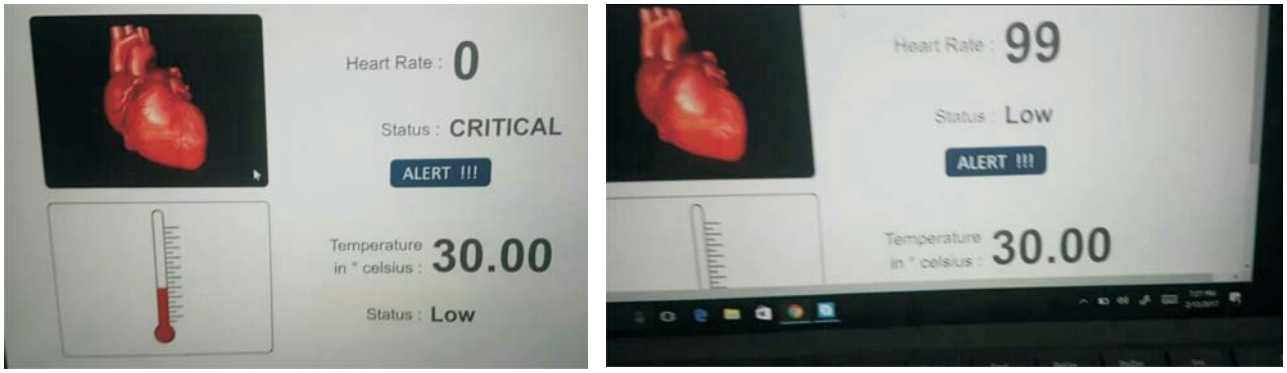

Figure 9: The Output of Health Monitoring System

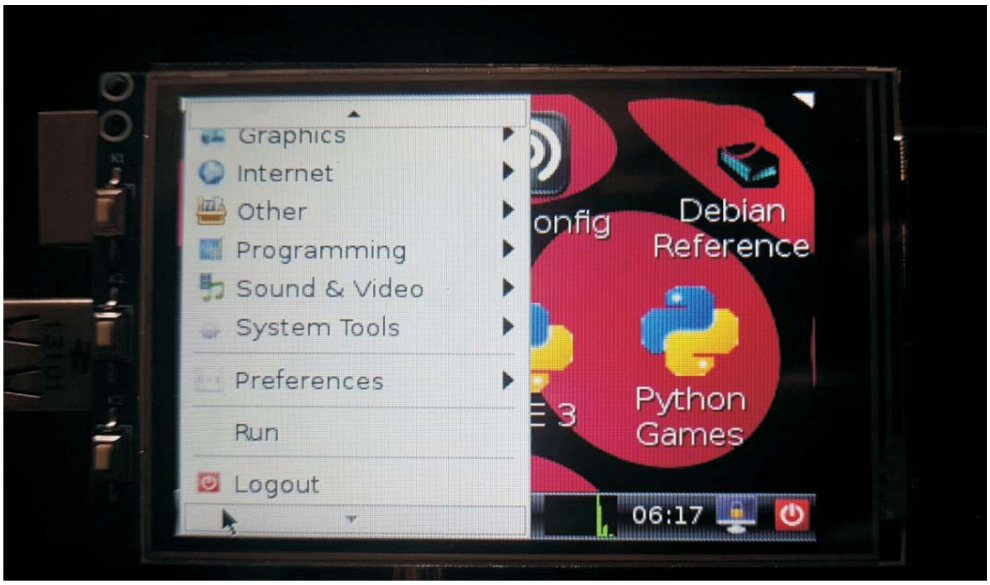

Figure 10: The Working Smart Display

Figure 11: Assembled Worktop with ergonomic Adjustments

7. CONCLUSIONS

The project is inspired by the hectic working condition of the people who have long hours of desk job. The worktop is successfully made, such that is can be used for providing the workers a comfortable work experience which will not only help to reduce their stress levels but also help them in achieving better efficiency. With subsequent research and advancement we can incorporate other features as well into this very same worktop. Thus, it also provides a scope for future improvement and research.

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