SMART AND INTELLIGENT POWERED IRON BOX

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***Abstract*—** Iron boxes are used in our day to day life .In these iron boxes temperature is controlled mechanically. We all are leading a busy life so we forgot to adjust the temperature before ironing the clothes .It will damage the clothes. To overcome this issue, we are presenting a new idea-"SMART AND INTELLIGENT POWERED IRON. BOX". In this, the temperature controlling is fully automatic Temperature controlling is done with two sensors ,one is Fabric detecting sensor Which senses &detect different types of fabrics such as cotton ,polyester,nylon etc. and the second sensor is a temperature controlling sensor which automatically set the temperature of Iron box according to different fabrics .When we are ironing different fabrics ,the temperature will be setted up immediately(fastly).Firstly the temperature becomes a moderate value then it changes to the required temperature needed for the ironing of fabrics. AI based image processing technique is used in the fabric detecting sensor. Selecting the correct setting on an iron box can make the difference between a good job and a disaster.
It is a frequent problem that our clothes get burnt while ironing. This mainly happens when the iron box is left idle when attending any phone calls or engaging in any other activities. Ironing works by loosening the bond between long chain polymer molecules in the fibers of the material. SMART AND INTELLIGENT POWERED IRON BOX preventing fabric damage.It design that uses an innovative framework and motorized mechanisms to effectively iron various clothes by minimizing the difficulties in the task of ironing.

I. Solution in detail

Many people doesn't know much about the different fabric materials. So manual temperature controlling will become difficult. Here is the solution for our all problems SMART AND INTELLIGENT POWERED IRON BOX will make our lives easier. Decision making is made easier with the help of AI. We didn't have to worry about setting the temperature for ironing. This iron box makes decision by itself, Which will make ironing processes much easier and faster. It is fully automatic. It has wide varieties of features, which will solve our all worries about ironing. It is energy efficient, and low cost comparing to other smart iron boxes.

II. Technical Explanations

When iron box is kept on the cloth, Ultrasonic sensor will get activated. Then it triggers the high resolution CCD camera. AI based image processing technique is used for detecting the type of fabric that we are going to iron. Required temperature will be set after fabric detection. The produced heat will be transferred to the sole plate of iron box. Temperature sensor is used for setting the required temperature for ironing. Also, it controls the temperature needed for the ironing variety of clothes. It is by reducing the temperature automatically, when it reaches the temperature limit. Sensor get activated when temperature reach the limit. Using Arduino or Microcontroller, this system can be implemented. Supply will be disconnected after reaching the required temperature for better ironing with the help of fast switching element MOSFET. This will save energy consumption. When the temperature drops below the moderate value, the get activated again and the temperature will be set. Through this, damages occurring in clothes due to ironing can be avoided.

When the detected fabric is cotton or linen, the steam spray nozzle will get activated and steam is sprayed on the fabric. The time duration of steam spraying can be adjusted. All these details such as the type of cloth, temperature and the duration of spraying will be displayed on LCD.

Iron Setting Temperatures in Celsius and Fahrenheit

If your iron uses a different scale or you want to know more exacting temperatures for ironing different types of fabric, follow these guidelines:

Linen: 230 C/445 F
Triacetate: 200 C/390 F
Cotton: 204 C/400 F
Viscose/Rayon: 190 C/375 F
Wool: 148 C/300 F
Polyester: 148 C/300 F
Silk: 148 C/300 F
Acetate: 143 C/290 F
Acrylic: 135 C/275 F
Lycra/Spandex: 135 C/275 F
Nylon: 135 C/275 F

How to Manage the Temperature of Your Iron

Unless you are just ironing a single garment, separate your wrinkled clothing and linens by type of fabric before you begin ironing. Start by ironing the items that require the lowest temperature like acetate and nylon. Then move to silks, polyester, and other synthetic fabrics like olefin. Finally, iron cotton and linen fabrics.

If you must switch back to a lower iron temperature, give your iron at least five minutes to cool down before you use it again. You'll be glad you did!

When in doubt about what temperature to use, start low and iron on the wrong side of the fabric with a pressing cloth. You can always move the temperature up gradually to remove tougher wrinkles and still prevent scorching. Scorch marks can be difficult to remove but not always impossible if caught early and treated while they are light in color.

Cloth detection

sensors are available to detect clothing or fabric's material.Now robots can identify with following sensors based on:

- Vision based:High resolutions camera for image scan and modifications to assess the pattern,structure and fibre microscopic analysis can determine the fibres.Please note that every kind of fibre have unique appearance under microscopic view thus material can be identified.
- Tactile based :The BioTac, with advanced human-like tactile sensing, is the leading product in machine touch.The design consists of a rigid core surrounded by an elastic liquid filled-skin to give a compliance remarkably similar to the human fingertip.

The BioTac is capable of sensing: force, vibration, and temperature which is identical to human touch capabilities. These sensory capabilities have been incorporated into the device without placing a single sensor in the skin. Instead, all of the electronics are protected inside the rigid core.

Ironing process is a repeated manual task carried out by people daily. Conventional ironing methods always require significant amount of physical user interaction which is time consuming. As a solution, a research has been carried out to implement a smart iron rack with a mobile application that enables user to remotely perform the ironing process. As illustrated in figure below, the device connects with the mobile application through Wi-Fi and performs many tasks including hanger detection, wrinkle detection in cloths, identification of steam irons' water levels and sending notifications to user. Iron rack consists of 5 hangers and a wide angle camera that moves along the horizontal beam to detect the clothes. When the user specifies a hanger number, the camera moves to the hanger position to check the availability of the cloth. Afterwards, the steam irons attached to the beam move vertically to iron the both sides of clothes. If the hanger number is not specified, the clothes on all five hangers will be ironed. The availability of the cloth on a particular hanger is detected using template matching algorithms in image processing. SIFT (scale-invariant feature transform) algorithm captures all interesting points of the hanger and shape of the hanger is taken as a key measure to decide the existence of the cloth. Raspberry-pi device which is mounted to micro controller, processes the images in order to determine the level of wrinkles in the outfit before and after the ironing process. "Grabcut" algorithm with localize Gaussian Mixture Model(GMM) is used to classify the foreground and background pixels in order to extract only the cloth from its background. Canny edge detection algorithm is used with (100,200) double thresholds to determine the number of wrinkle pixels in the cloth. The system was tested with 100 outfits made in cotton and silk materials. The accuracy of the system was tested in two stages. System could be able to achieve 0.80 F1 score for detecting clothes on hangers and 0.71 F1 score for detecting wrinkles in the clothes. "Smart iron rack" is a cost effective solution which is capable of remotely ironing 5 clothes at a time.

CCD-Camera

A **charge-coupled device** (**CCD**) is an integrated circuit containing an array of linked, or coupled, capacitors. Under the control of an external circuit, each capacitor can transfer its electric charge to a neighboring capacitor. CCD sensors are a major technology used in digital imaging.In a CCD image sensor, pixels are represented by p-doped metal–oxide–semiconductor (MOS) capacitors. These MOS capacitors, the basic building blocks of a CCD,[1] are biased above the threshold for inversion when image acquisition begins, allowing the conversion of incoming photons into electron charges at the semiconductor-oxide interface; the CCD is then used to read out these charges. Although CCDs are not the only technology to allow for light detection, CCD image sensors are widely used in professional, medical, and scientific applications where high-quality image data are required. In applications with less exacting quality demands, such as consumer and professional digital cameras, active pixel sensors, also known as CMOS sensors (complementary MOS sensors), are generally used. However, the large quality advantage CCDs enjoyed early on has narrowed over time and since the late 2010s CMOS sensors are the dominant technology, having largely if not completely replaced CCD image sensors. CCDs are used in optical microscopes because they can possess over 10 million pixels, which enables many samples to be seen clearly, as well as a low noise ratio, ability to image in color, high sensitivity and a high spatial resolution which all contribute to the high-quality images that are necessary for modern-day science. One other key feature is that CCDs can rapidly image a sample, which is necessary for analyzing the microscopic processes that happen in a sample, as well as the sample itself. In modern-day microscopes, the CCD cameras used often range between 0.1 and 20 MHz.

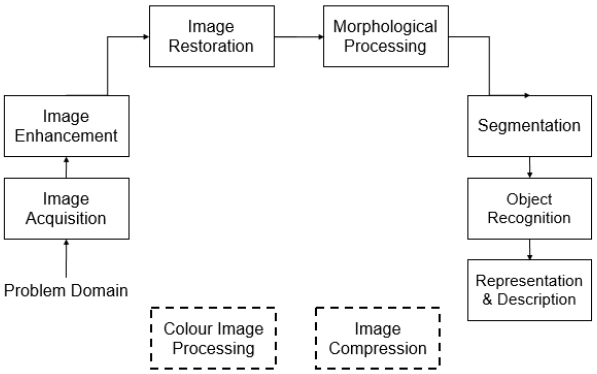


Fig 1:block diagram of image processing

Prevent Fabric Damage

Iron box is an electronic device used to remove wrinkles on the clothes. It is a roughly triangular surfaced device, heated electrically and pressed against the cloth to remove creases. It is named for the metal of which the device was historically made commonly, and the use of it is generally called ironing. This process of Ironing happens due to the loosening the ties between the long chains of molecules that exist in polymer fiber materials. Due to the heat and the weight of the ironing plate, the fibers get stretched and when it cools, the fabric maintains its new shape. Some materials require the use of water to loosen the intermolecular bonds, like cotton. Current from the power supply is drawn by the iron box. This current heat up the coil inside it. Further, this heat is transferred to the base plate of this device, which is pressed against the cloth to remove creases. Sole plates are the bottom piece of the box. To regulate the temperature, thermostat is present. A knob is also provided which can be rotated to indicate the material type. In this busy world, people find no time to concentrate on their daily activities. As a result, many accidents occur. Accidents also happens while ironing. While placing the iron box on the cloth for a prolonged time, the cloth often gets damaged. The temperature sensitivity is different for various cloth material types. The main reason carelessness leads to the burning or melting of the fabric. Additionally, waste of energy, money, time also accompanies it. The solution to the problem is designed by modifying the existing iron box by adding the features of automatic cut off and alarming system to warn the user. We modify the already existing iron box by incorporating ultrasonic sensors, Arduino Nano, relays, buzzer and led. Arduino Nano is placed inside the plastic handle over the iron cover which is connected to the ultrasonic sensor that protrudes from the plastic handle. Ultrasonic sensor is placed such that the sensing part is facing the cloth to be ironed. A buzzer and led are placed on either side of the knob. A relay is connected to the main supply. By this way, we can protect our clothes from damage to a great extent.

Working Of The Solution: Arduino Uno is placed inside the plastic handle over the iron cover. This acts as the control center for all operations of the system. Arduino is connected to the ultrasound sensor which act as the input to the Arduino. It protrudes from the plastic handle and the height is measured constantly in each second. Ultrasonic sensor is placed such that the sensing part is facing the cloth to be ironed. When the distance or height remains constant for a period of time which is calculated by finding the lowest ignition temperature of the lightest material to be ironed at the highest temperature. If the distance remains constant for this period of time, the buzzer and led is made on and the relay cuts off the power supply making the iron box off and the temperature on the cloth is reduced leading to no fabric damage. A buzzer and led are placed on either side of the knob.

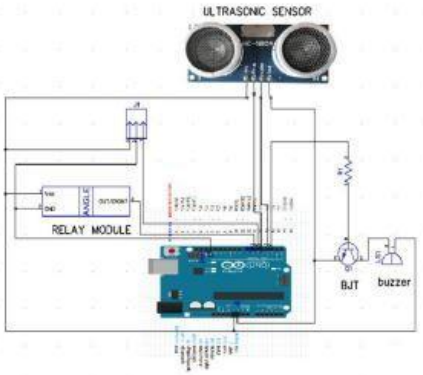


Fig2: Arduino uno

Buzzer: A buzzer is an audio signaling device. It can be of different types, mechanical, electromechanical, or piezoelectric. They are used in alarm clocks, timers, indicators etc.

Arduino Uno is a small, flexible, compactible and microcontroller board. It was developed by arduino.cc in Italy. This is based on ATmega328p (Arduino Nano V3.x)/Atmega168 (Arduino Nano V3.x). The digital pins present on the Uno can be used as an input or output, pin Mode(), digital Write() and digital Read() functions. This operates at 5 volts. Each pin provides or receives a maximum current of 40mA and has an internal pull-up resistor of 20-50kOhms, which is disconnected by default.

HC-SR04 Ultrasonic Sensor : HC-SR04 ultrasonic sensor is a module having 4 pins, they are Vcc, Trigger, Echo and Ground. This sensor is widely used for many applications. Commonly used for distance measuring and sensing the object. This module has 2 projections in the front known as ultrasonic transmitter and receiver. The transmitter transmits an ultrasonic wave which is then reflected by the object that is present in the direction of wave propagation. The distance is calculated by the formulae, distance=speed * time. The universal speed of ultrasonic wave is 330m/s, the time taken by the ultrasonic wave to come back is calculated. During this time the echo pin turns high. Now this distance is calculated using microcontroller or microprocessor.

Digital Relay: are used for detection of electrical faults in industrial power transmission and power distribution system. They are protective computer-based systems that use software algorithms. It provides metering, communication and self-test function.

Temperature sensor

This application note shows it is possible to use an extra low-cost microcontroller in everyday equipment unaffected by any significant changes for a long time. A cloth iron was chosen because it has a temperature control implemented using reliable mechanical bimetal, but with a big hysteresis and without any special emphasis on accuracy (there may be temperature drifts of about 30°C or more). Much better temperature control can be obtained using an embedded control system. For a cloth iron, this means some temperature sensor, a cheap and simple MCU, and a powerful TRIAC as an actuating device. In this application, the new low-cost MCU MC9RS08KA2, a member of the RS08 family of 8-bit microcontroller units (MCUs), is inexpensive. The MCU (RS08KA2) does not have an ADC module, yet there is a comparator and also an internal bandgap reference voltage for comparing voltage levels on an MCU input. Therefore, it is possible to emulate an ADC with one resistor and one capacitor by measuring the time needed for charging the capacitor to the reference voltage level. The benefit of this replacement is the change from an inexact on-off control system to a more precise and more sophisticated control system, significantly better (more stable) at sustaining adjusted temperatures. One further thing is the minimization of disturbances going back to the supply network during switch-on and switch-off. Switching at zero (called zero crossing) is used when the electrical current is also at a zero level and the potential electrical disturbance doesn't arise. By using the appropriate control method and components, ironing can be considerate of the clothes. The RS08K2 has eight pins, and this application note uses seven of them. One general-purpose input/output pin is available for additional functionality. For instance, there may be some movement sensor connected and the information from this sensor can be used for implementing some safety feature. Typically, this is an automatic heating shutdown after some defined timeout.

There are several kinds of temperature sensors of varying price, sensitivity, temperature range, and size. Because high temperature sensors are generally more expensive, this design uses a low-cost silicon temperature sensor, the KTY84-130 (Philips Semiconductors), with a positive temperature coefficient of resistance and is suitable for use in measurement and control systems over a temperature range of 40 to +300 °C (a common iron works in a range of approximately 50 to 230 °C).

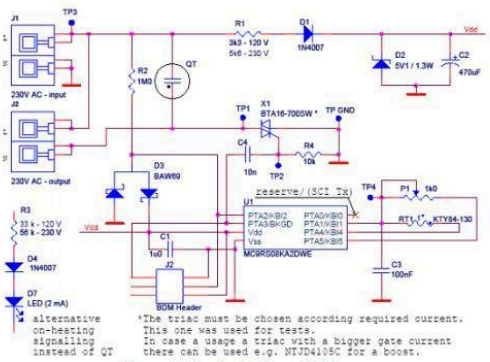


Fig3: Temperature sensor

III. Existing Solutions

Iron box with fiber detection technique hasn't been implemented so far. So this idea is much easier and user friendly. There are a lot of sensors available for temperature detection but none of these sensors are used in iron box for temperature detection. Fiber detection technique is not employed in iron boxes, so this will be a good start.

IV. What is unique about your idea?

Desired temperature will be set after fibre detection then this temperature is transferred to sole plate of iron box .For e.g. If the temperature required to iron linen cloth is 250^0C. Then the sole plate will be heated to 250^0C.After reaching this temperature, iron box will be turned off automatically without the functioning of bimetallic strip. For this process we used the fast and accurate switching element- MOSFET. There by we could remove the mechanical part in the usually used iron boxes and avoid the corrosive components. This is solution for preventing corrosion while using these types of mechanical components. Like this, it have a fabric damage prevention mechanism. It will ensure the quality and durability of our clothes. Also we implemented a automatic steam spraying mechanism. In all existing iron boxes steam spraying mechanism is not automatic. But in the SMART AND INTELLIGENT POWERED IRON BOX, steam spraying mechanism is automatically enabled when the detected fabric material is linen or cotton. It is a highly energy efficient product, since all the electronic components used are having low power ratings. These are the main highlight of our product.

V. Do you have targeted audience ? What is the scope of the product in future ?*

SMART AND INTELLIGENT POWERED IRON BOX can make our life easier. We can use this product easily even if we didn't have any basic knowledge about different fabrics. After detecting the fabrics the preferred temperature is set automatic. It will save our time. Fabric damage protection technique is also employed here, which will increase the quality and durability of our clothes. There by we can save money and our precious time. Fabrics have a great role in our life. We can ensure its quality and durability by using SMART AND INTELLIGENT POWERED IRON BOX. We can make our life smarter.

VI. What is your marketing strategy?

SMART AND INTELLIGENT POWERED IRON BOX has many interesting features. It is energy efficient and save our time. Components used here is having good quality and low cost. This reduce the cost of production. Artificial intelligence technology is used is this product. This will be made available in markets with low cost. Since this iron box has many interesting features and energy efficient than the existing iron boxes. It will make a great change in our lives and become a smart idol product. It will make our lives much more smarter and increase the quality of life..

VII. How will you outrun your competitors?

Iron box is a main product in our home, it is used atleast once in a day a member of family. This SMART AND INTELLIGENT POWERED IRON BOX is a golden gift to us in our busy life, where we depend mainly on these types of automatic devices. Therefore, this product will have a great role in our daily life. We have faith in our product, that everyone will switch from normal iron box to this smarter one. We are sure about the implementation and one day, it will become success and very popular among people. We all are trying to make our life much easier, so this idea will be one of best idea. SMART AND INTELLIGENT POWERED IRON BOX could make a great change in our life, that will take us to a next level.

VIII. What is the outcome of your idea,with estimated time and cost ?

The main aim behind this idea is to ensure the quality of life and to provide best life style. In this 5th generation, most of the works are done by robots. Our idea if fully AI based. Changes are inevitable in this era of robots. So quality, time accuracy etc. are really important. Even though the cost of SMART AND INTELLIGENT POWERED IRON BOX is greater than the all existing manually operated iron boxes, but this will provide good and a better quality outcome.

It will take some time to train the images of fabrics. Because, if we take one type of fabric, it will have different varieties in it. So we have to train about 300-500 images. Even though it consume much time for training. Later on when the manufacture of this iron box starts, we can use the same images that we have trained earlier. CCD camera is used here. It is somewhat expensive and it will range about Rs. 2000-3000. All other components such as the 3 sensors are cheap and of good quality. SMART AND INTELLIGENT POWERED IRON will be available in market with an average cost of Rs.5000 in the first stage of marketing. The Ordinary iron boxes, that are already available in the market costs about Rs.3000. It could make a great leap in the technology. i.e. this product will be available for just Rs.5000 with full features. It is really great and makes your life smarter.

IX. Sketches to illustrate you ideas/Block diagrams?

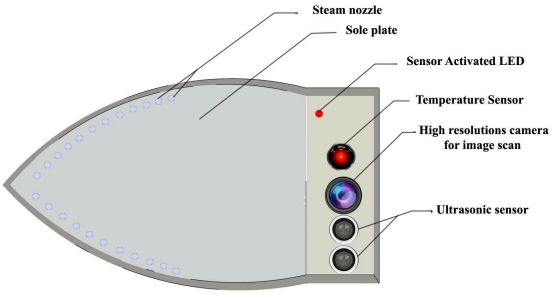
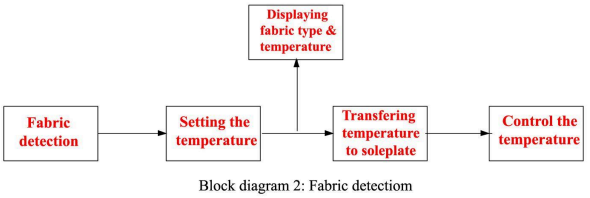
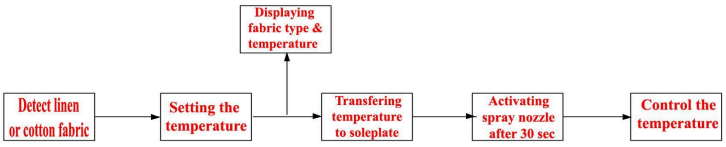


Fig4: design of smart and intelligent powered iron box



Block diagram 2: Fabric detectiom



Block diagram 3: Spray nozzle activation

Fig5: working of smart and intelligent powered iron box

References(if any)

[1] Artificial Intelligent ,A Modern Approach by Stuart Russel and Peter Norving