IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 7.39 ⁜ Vol. 11, Issue 3, March 2022

DOI: 10.17148/IJARCCE.2022.11323

CONVERTING CONVENTIONAL WELDING HELMET INTO SMART IOT BASED WELDING HELMET FOR SMART VISUALIZATION

Sarthak Sharma[1], NamanKatiyar[1], PrakharTyagi[1], Neeraj Kumar[2], Brij Bhushan Tyagi[2]

Student, Department of Mechanical Engineering, Inderprastha Engineering College, Ghaziabad, 201010, UP, India [1]

Assistant Professor, Department of Mechanical Engineering, Inderprastha Engineering College, Ghaziabad, 201010, UP, India [2]

Abstract: This paper utilizes a technology that is Real-time monitoring of welding parameters using IoT to transmit the data from the working environment to the monitoring station. Welding operations include several hazards like Suffocation, fumes poisoning, and gas explosions which are dangerous to both the worker and others in the territory. Welding helmets include several sensors to detect anomalies in temperature and fumes exceeding the threshold range to prevent this warning alarm system from being utilized. To boost wellbeing, the breaking point switch is utilized to effectively decide if the specialists had worn their caps appropriately or not.

Keywords: RFID, Arduino, Wifi-technology, IoT, Monitoring, and control system**.**

INTRODUCTION

Welding is performed between at least two comparative or different metals to consolidate them, permanently by applying intense heat between them, which causes the parts to intermix after melting. All of the manufacturing industries such as aerospace, shipyards, civil engineering structures, and the mining industry have wide use of the welding processes[1]. As indicated by the World Health Organization (WHO), around 250 million individuals suffer work-related wounds every year around the world. Especially in non-industrial nations, welding is one of the positions that lead to these word-related wounds[2][3]. With the assistance of the great recurrence, high voltage electric current, and compacted gas, it likewise includes the consuming of motions, coatings, and gas therefore it may prompt mishaps because of carelessness. A welding cap is worn by the welders to protect their eyes, face, and neck from streak consumption, bright light, sparkles, and infrared light. Until the 1930s, most welders utilized goggles and facial coverings to safeguard their countenances. Welders were not adequately protected from sparks and toxic fumes by this kind of crude safety equipment[4]. The welding cap offers some level of respiratory security expecting the metal smoke level inside is lower than that in the breathing zone outside the head defender. Generally, designing controls are liked for controlling airborne toxins delivered by welding processes.

The utilization of welding head protectors is for the most part perceived as giving some insurance from seeing the openness [4]. Early welding helmets had polarized lenses for eye protection, but may not have been equipped with effective UV radiation protection. Auto-darkening technology meant lens shades with sensors that detected an arc automatically darken as soon as an arc was struck. This will help the Welding helmet market gain the upper hand as they use the report as a source of valuable market information. Welders can begin welding with their helmets in a safe, down position, rather than having to adjust the shield [5].

LITERATURE REVIEW

Antonini et.al (2005) Processes including hardened steel can deliver vapor that contain possibly cancer-causing metals(e.g. Cr, Ni). These vapors might cause unfavorable well-being impacts on different organs and frameworks, especially the respiratory lot and sensory system. Studies have shown that welding exhaust triggers the post-provocative impacts of oxidative pressure through their solvent middle-of-the-road metals. The purpose of this study was to examine

 This work is licensed under a Creative Commons Attribution 4.0 International License

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 7.39 ⁜ Vol. 11, Issue 3, March 2022

DOI: 10.17148/IJARCCE.2022.11323

how welding fumes influence free radicals, DNA damage, cytotoxicity, and apoptosis induction, factors that may contribute to lung cancer development [6].

Park et.al (2007) studied the development and ergonomics evaluation of AR and implements it on the welding helmet which has a camera above the user's eyes. A video sequence viewed by the computing system of this user can adjust the brightness of bright arc radiation and display welding parameters as well as information about the welding process. By offering relevant information at the same time as being as invisible as possible, the helmet supports the welder's work and avoids distracting him/her at any time. The welder is no longer able to see his working environment directly from the helmet. The helmet shows a video sequence in real-time of the welding process and its relevant information, such as current, voltage, and wire-feed speed. One more valuable element of the welding head protector is that welding boundaries can be recorded during welding and saved along with the video succession [7].

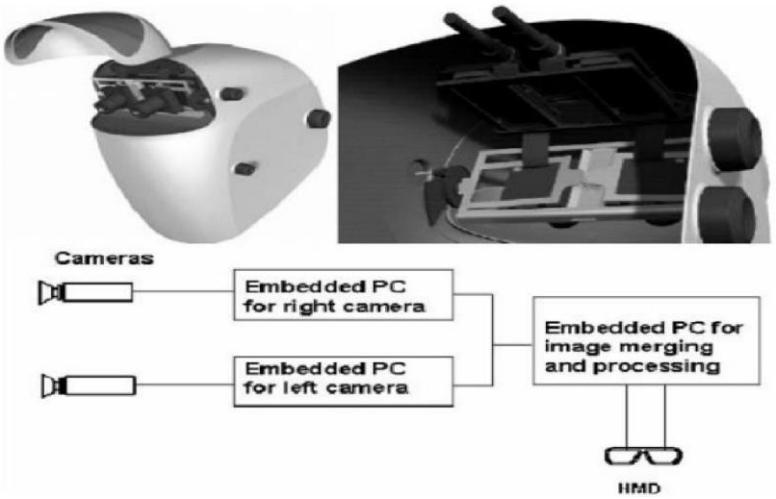


Fig. 1 Schematic of the AR welding helmet [7]

Quinlan et.al (2010) An investigation was conducted of metal fumes inside and outside welding helmets during the welding process (concentrations of zinc and iron were measured to investigate if using a welding helmet attenuated exposure to airborne metal fumes). All welding helmets used in the experiment met the standards of the American national standard institute. The information demonstrates that the convergence of zinc and iron inside the welding head protector is almost equivalent to outside the cap. In 23 out of 23 perceptions, there were more significant levels of iron and zinc inside the protective cap than what was estimated with individual breathing zone checking at the shoulder. Welding protective caps give incapable and problematic constriction of openness to welding vapor.[8].

Erden et.al (2011) Through the use of an air paintbrush, the experiments were simulated using a setup that simulates an experimental setup so that an unskilled worker could be assisted with the movement of a welding torch and assist with manual welding with a robot. An end-effector attached to a haptic robot carries the torch. It is a joint operation between humans and robots. The robot smothers the unexpected and sudden movements while the human control the course and speed[9].

Zhong et.al (2012) The continuous crease following innovation was executed in gas tungsten bend welding (GTAW) to take care of the issue of welding robots not having the option to follow creases during the interaction. The robot is outfitted with a dream sensor framework planned explicitly to catch clear and consistent welding pictures. New boundaries have been extricated from welding pictures utilizing another superior Canny calculation, which utilizations picture examination to recognize creases and pools. To test whether the innovation meets the necessities of value control of crease shaping, an examination of the ongoing crease was led to follow innovation, followed by some experiments to test the accuracy of the segmented PID controller.[10].

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 7.39 ⁜ Vol. 11, Issue 3, March 2022

DOI: 10.17148/IJARCCE.2022.11323

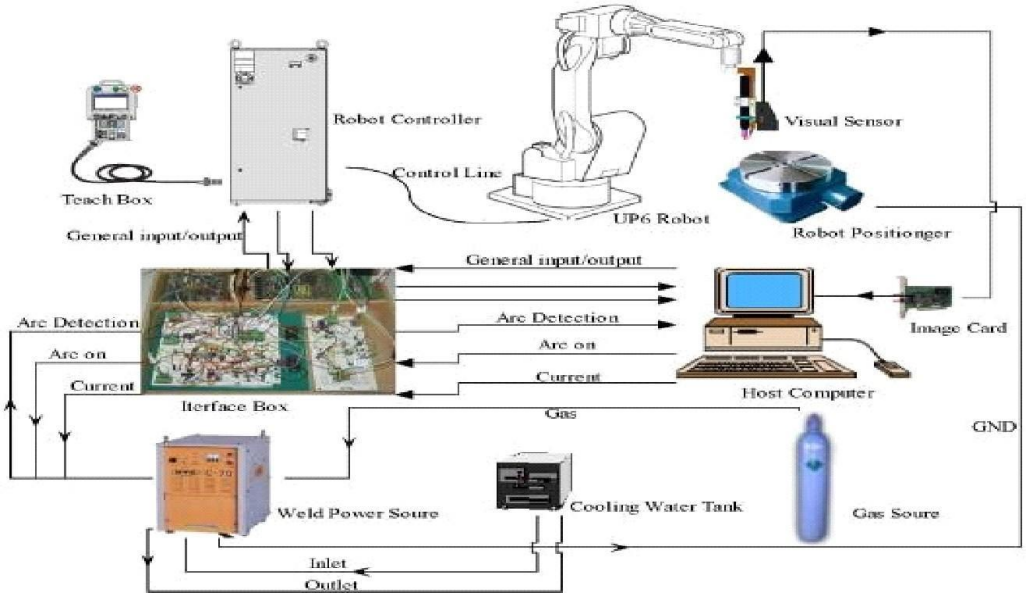


Fig. 2 The schematic graph of the test contraption [10]

Xiao et.al (2013) reviewed a mechanical variable electric welder helmet that can consequently change the light of the arc by using electrodeless light LCD lenses and electrical control, the eyepiece lenses can be controlled by magnetism[11].

Singh et.al (2013) deliberate the contemplations involved in the welding system. The techniques involved in the establishment of industry concluded all the basic and highlighted points involved in industrial work in the welding process that concludes welding standards, label information, parameters of welding. The aim is to avoid all the disintegration and risk involving factors like gases, fumes, electricity, magnetic field hazards. So it works to protect risk control measures and design in the innovation of the welding process [2].

Lee et.al (2015) IoT is gaining attention from a broad range of industries as it is the main aspect of future technologies. As a component of his show, he sums up five IoT advancements that are fundamental for the improvement of IoT-based items and administrations. The web of things, for example, RFID-based following and home systems administration, are substantial advances that can be estimated right away; they overlook flexibility in investment that can be reversed or scaled up. These frameworks give administrators and mechanized regulators with continuous, continuous information on gear execution, energy use, and environmental conditions, empowering them to continually screen when and where execution is being achieved. The innovation is savvy in examination with other IT arrangements [12].

Wen et.al (2016) The focus of this paper was on detecting methodologies that are used for continuous frame welding quality monitoring, and how they could be applied to data fusion processes. A case study will be given [13] of aluminum

GTAW condition monitoring using data fusion.

Fig. 3 Robotic welding system & Experiment designing [13]

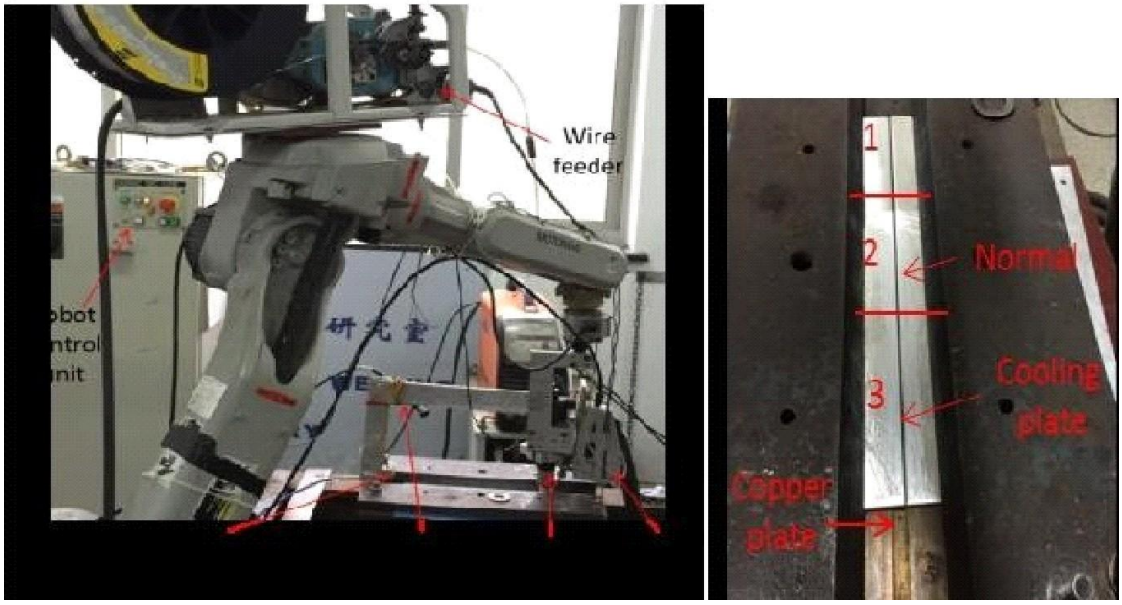
IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 7.39 ⁜ Vol. 11, Issue 3, March 2022

DOI: 10.17148/IJARCCE.2022.11323

Mgonja et.al (2017) explored the different studies about the hazardous profession involved in the welding process, especially in Arc welding, and how the workers can avoid such hazards by taking all the necessary safety measures. Arc produces different strong UV and infrared radiation, fumes, and dust that directly affect the eyes, face, head, and other body parts. Arc



generated by the use of electric current and compressed gases leads to the generation of fluxes, fumes, electric arc radiation, electric shocks, etc of high velocity and frequency which is the cause of different inabilities, diseases, and disorders. To minimize such hazards corrective steps are taken to ensure good health. Some are, work safety programs, physical exercise, proper use of welding helmets, gloves, and other accessories [1].

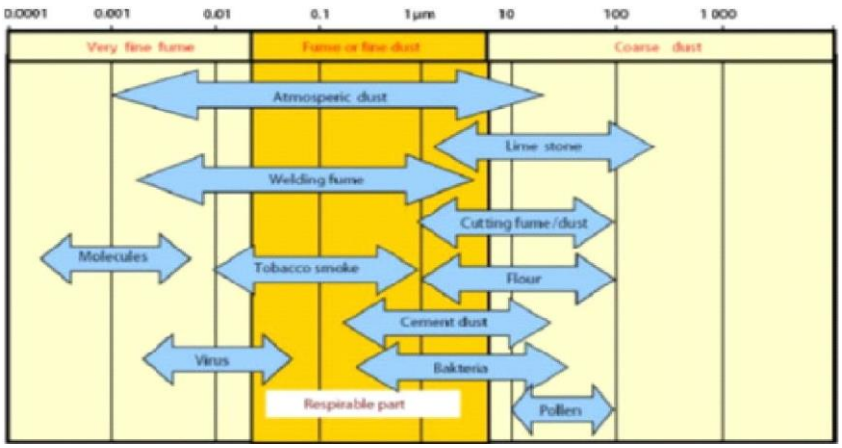


Fig. 4 Particle size for different pollutants [1]

Chen et.al (2018) scrutinized the use of IoT & artificial intelligence(AI) in the field of welding. The researchers introduced the data-driven welding expert system which was capable of collecting optical, sound as well as electrical information during the process. The author compared the gathered data and compared them with the WPS demanding data. It was observed that real-time monitoring can be possible using the proposed welding expert system equipped with various types of sensors, input/output interfaces, and their integration. The vision information along with sound information was taken as the parameters to be studied. The authors found a significant change in conventional systems with the inclusion of IoT &AI [14].

IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940

International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 7.39 ⁜ Vol. 11, Issue 3, March 2022

DOI: 10.17148/IJARCCE.2022.11323

Fig. 5 Display interface of data-driven welding expert system based on IoT [14]

Nandhini et.al (2018) judged the problem of safety for workers during hazardous situations, to overcome the problem this system provides emergency alerts to the monitoring station. It provides the real-time monitoring of harmful gases and provides alert switches in the working environment for emergency purposes. There is a buzzer that will activate when the gas sensor exceeds the threshold level [15].

Katheria et.al (2020) review the tool to achieve the requirement of higher efficient skill training programs for hazardous environments. The use of AR/VR licenses the reduction in schedule, materials, and cost in correlation with conventional preparation techniques [16].

Wanjari et.al (2020) investigated the different risk factors involved in the welding process which are both physical and psychological. Health-related problems such as chock respiratory system, cardiac disorders, arrhythmias skin burn, hearing problems, musculoskeletal disorder, etc. So to educate and make them aware of such problems different training programs and apprentices are being organized and funded so that safety can be ensured to an extent. Welding initiatives are taken to national security standards and implement preposition preparing programs for welders [17].

NGO et.al (2020) projected the idea of sensor technology and wireless communication that could be constructed and established with a connection with the powers of computer devices in the vision that advancements would be seen in machine learning and rapid growth can be seen in the construction industry to advance such sensor-based safety devices [18].

The fumes which are generated by the electric arc will get detected by this smart welding helmet. If excess fumes are generated during the process the welder can directly receive the information which helps the welder to stop the task immediately. The person at the base station can directly access the information on the ongoing work and also be able to store the data on welding parameters like the temperature of the whole welding process and the fumes produced during the process

CONCLUSION

An IoT-based data-driven welding expert system was demonstrated in this paper. With the development of technology, the use of smart devices will make the welding process safe. The use of this device will help in monitoring and collecting data regarding welding process parameters and make sure the process is safe for operators and machinery.

- The longer time of exposure to fumes in welding may result in short-term and long-term diseases mostly related to respiratory and nervous systems. In each cycle, various exhausts are created because of the filler material and metal to weld.
- When the arc starts, the welder cannot see his surroundings directly when using the existing helmet. In a welding cycle, a blunder might emerge in boundaries like current, voltage, and wire feed speed.

DOI: 10.17148/IJARCCE.2022.11323

- Using the expert welding system based on the IoT & Artificial intelligence in welding will reduce the error generated during welding. Using security features will also lead to a decrement in accidents that happen during welding.

- As the data was previously monitored manually the use of IoT will make the process quick. It is now easier to obtain welding process data including welding current, welding arc voltage, welding sound, and welding optical data with this innovation.

REFERENCES:

1. C. T. Mgonja, "The Effects of ARC Welding Hazards To Welders and People Surrounding The Welding Area," 2017.
[Online]. Available:http://iaeme.com/Home/journal/IJMET433editor@iaeme.comhttp://iaeme.com

2. K. Singh and A. Anand, "SAFETY CONSIDERATIONS IN A WELDING PROCESS: A REVIEW," International Journal of Innovative Research in Science, Engineering and Technology, vol. 2, no. 2, 2013, [Online]. Available: www.ijirset.com

3. K. Sabitu, Z. Iliyasu, M. M. Dauda, and K. Sabitu, "AWARENESS OF OCCUPATIONAL HAZARDS AND UTILIZATION OF SAFETY MEASURES AMONG WELDERS IN KADUNA METROPOLIS, NORTHERN NIGERIA," 2009.

4. "History of Welding Helmets." http://weldinghelmetgenius.com/history-of-welding- helmets/ (accessed Nov. 22, 2021).

5. "The History of the Welding Helmet - Blog | Welding Safety News | AWS | AustraliHTTPPs://www.awsi.com.au/blog/post/the-history-of-the-welding-helmet (accessed Nov. 22, 2021).

6. J. M. Antoniniet al., "Effect of stainless steel manual metal arc welding fume on free radical production, DNA damage, and apoptosis induction," Molecular and Cellular Biochemistry, vol. 279, no. 1–2, pp. 17–23, Nov. 2005, DOI: 10.1007/s11010-005-8211-6.

7. M. Park, L. Schmidt, C. Schlick, and H. Luczak, "Design and evaluation of an augmented reality welding helmet," Human Factors and Ergonomics In Manufacturing, vol. 17, no. 4, pp. 317–330, Jul. 2007, DOI: 10.1002/hfm.20077.

8. D. Liu, P. Quinlan, and H. Wong, "Welding helmet airborne fume concentrations compared to personal breathing zone sampling," American Industrial Hygiene Association Journal, vol. 56, no. 3, pp. 280–283, Mar. 1995, DOI: 10.1080/15428119591017123.

9. M. S. Erden and B. Marić, "Assisting manual welding with a robot," in Robotics and Computer-Integrated Manufacturing, Aug. 2011, vol. 27, no. 4, pp. 818–828. DOI: 10.1016/j.rcim.2011.01.003.

10. Y. Xu, H. Yu, J. Zhong, T. Lin, and S. Chen, "Real-time seam tracking control technology during welding robot GTAW process based on passive vision sensor," Journal of Materials Processing Technology, vol. 212, no. 8, pp. 1654–1662, Aug. 2012, doi: 10.1016/j.jmatprotec.2012.03.007.

11. J. B. Xiao, X. L. Xie, and H. Zhang, "Transform three mechanical stepless simulation darkening welding helmet design," in Advanced Materials Research, 2013, vol. 734–737, pp. 2738–2741DOIoi: 10.4028/www.scientific.net/AMR.734-737.2738.

12. I. Lee and K. Lee, "The Internet of Things (IoT): Applications, investments, and challenges for enterprises," Business Horizons, vol. 58, no. 4, pp. 431–440, Jul. 2015, DOI: 10.1016/j.bushor.2015.03.008.

13. zhifen Zhang, G. Wen, and S.-B. Chen, Multisensory Data Fusion Technique and Its Application to Welding Process Monitoring. 2016. DOI: 10.0/Linux-x86_64.

DOI: 10.17148/IJARCCE.2022.11323

14. C. Chen, N. Lv, and S. Chen, "Data-Driven Welding Expert System Structure Based on Internet of Things," 2018, pp. 45–60. DOI: 10.1007/978-981-10-8330-3_3.

15. M. v Nandhini and P. G. Priya, "IoTBasedd Smart Helmet for Ensuring Safety in Industries." [Online]. Available: www.ijert.org

16. S. Kumar Katheria, D. Kumar, T. Ali Khan, and M. Kumar Singh, "Reality-based skills development approach in welding technology: An overview," Materials Today: Proceedings, vol. 47, pp. 7184–7188, 2021, DOI: 10.1016/j.matpr.2021.06.453.

17. M. B. Wanjari and P. Wankhede, "Occupational hazards associated with welding work that influence the health status of welders," International Journal of Current Research and Review, vol. 12, no. 23, pp. 51–55, 2020, DOI: 10.31782/IJCRR.2020.122303.

18. A. Asadzadeh, M. Arashpour, H. Li, T. Ngo, A. Bab-Hadiashar, and A. Rashidi, "Sensor-based safety management," Automation in Construction, vol. 113. Elsevier B.V., May 01, 2020. DOI: 10.1016/j.autcon.2020.103128.