New Gen Bathroom

Telugu Maddileti[1], Mandepudi Nobel Chowdary[2], Katkam Ashutosh[3]
Sreenidhi Institute of Science and Technology
[1,2]Electronics and Computer Engineering
[3]Electronics and Communication Engineering

Abstract

The modern generation is in the need of comfort, safety, and health benefits. The advancement of automation in every field made the work to be easier. The need for bathroom automation, due to the accidents that are happened in the bathroom is not recognized at the correct time and had led to death. Moreover, the comfort and health-improving parameters in the bathroom environment are in lack of development. In this paper, the intelligent bathroom design with multi-features that promote health, safety, and comfort to the modern man. In this system, the intelligent valve control and the smart shower with water-saving feature based on the distance and mold growth controlling with automated humidity controlled exhaust fan. The entire system provides the bathroom with smart facilities that ensure the hygienic bath to the modern man.

Keywords:-New Gen Bathroom, Impaired, Optimum Temperature Water, Ergonomics.

I.INTRODUCTION

Everyone wants to lead a comfortable life if safety is added to it then it would be of great benefit to us. Most of us require some great innovation in the category of personal hygiene and cleanliness. An innovative idea for comfort and safety comes closer to the implementation in real life. The need for safety to the modern man with considerations of health and comfort ensures the growth of the development of the technological advancements in the bathroom, providing enormous benefits to the man. Presently, safety in the bathroom is developed by camera technology [1]. The rate of a chance of unexpected death in any certain place has been increased. Moreover, the death of the patients suffering from various diseases and old people can occur at any time. So, the need for the development of safety systems is very important [2]. The need for the maintenance of the health in the present scenario is most important, because of the increase of the contaminants in nature. Healthier bath can be done with suitable temperature water, based on the weather conditions [3-4]. The allergies due to various molds in the bathroom caused due to improper ventilation [5]. The negligence of control of the skin health along with the overall body health will be maintained. Another factor in which modern man is dependant is comfort. The need for comfort to the disabled people and impaired people is an important factor to be considered. Application of technology can be developed to meet the comfort, health and safety needs of the human in the bathroom.
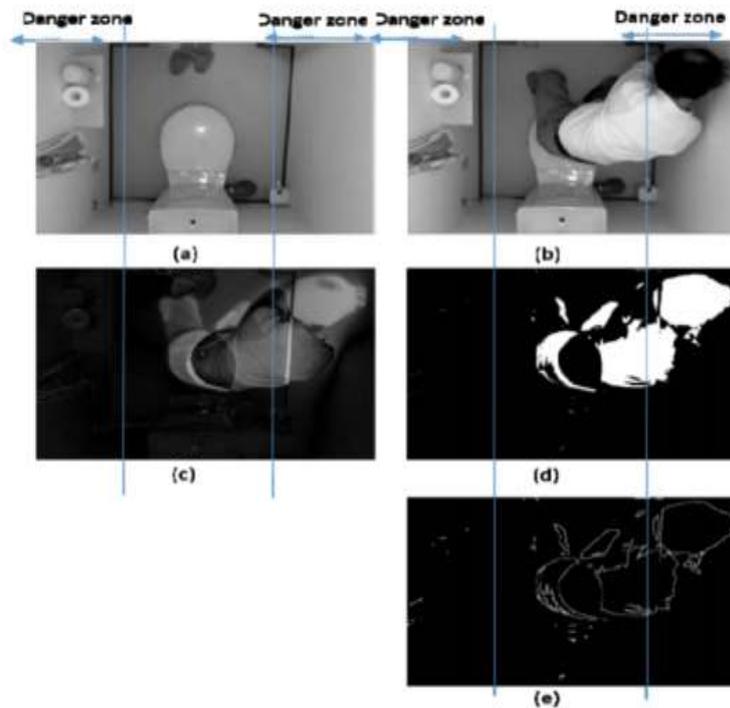
The rate of death due to the accidents caused in the bathroom is high as mentioned by Gören et al [6-7]. Moreover the safety in the bathroom in the present systems is less. The adjusting of the hot and cold water for bath is also an important factor for the maintaining the health benefits as researched by Bujnowski Et al [8]. The mould growth causes the allergies and diseases. The saving of the water with comfortable features is a task for humans to utilize the resources in a proper manner [9].

The present system was built by using the camera as the main component as shown in the Fig 1 and Fig 2, to process the image and detect the accidents in the bathroom as mentioned by Zhang et.,al [10-11]. But the usage of camera is a privacy issue and it is costly to depend on this system as identified by Nakashima [12]. So, the developed system will overcome the disadvantages of the existed system and with multiple features.
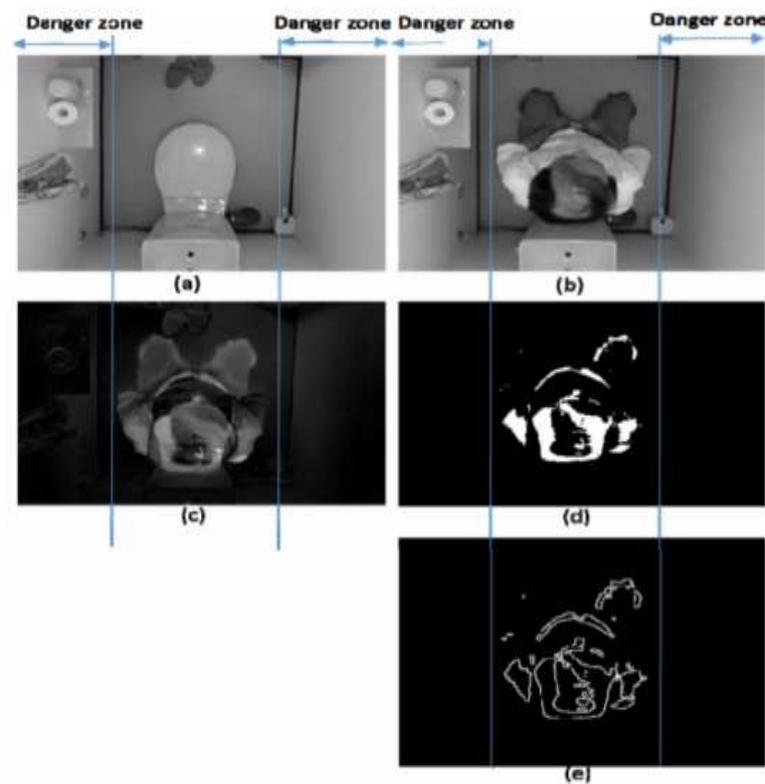
Experimental results for the safety case

Fig 1: Existing System Safety Case

Fig 2: Existing System Dangerous case

II. Proposed Algorithm

2.1 Motion Detection

Motion detection aims to identify the presence of the human in the bathroom, thus ensures safety in the bathroom. This can be helpful to reduce the mishaps in the bathroom like cardiac arrest, heart attack and unconsciousness. The need for safety is important in the present scenario because the death rate in any uncertain condition has been increased. The detection of the presence of the human in the bathroom can be done with the help of the Passive Infrared sensor [13]. It can detect the presence of the living organisms in its view range. It emits the passive infrared rays. These rays are absorbed by the living cell and detect the presence of the living being in the surroundings. The range of the PIR sensor is very high and the requirement of these sensors will be dependent on the size of the bathroom. A basic model of the sensors covering the entire volume of the bathroom is shown in the Fig 3. The lock of the door can be opened by switching the alert alarms so that the life of the human can be saved.
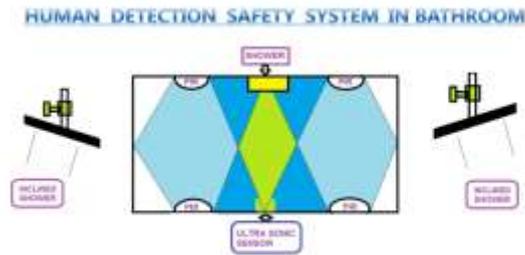
Fig 3: Human Motion Detection Layout

2.2 Health

The need for maintenance of health is very much important for everyone, especially for the old, newborn babies and impaired people. The type of water and temperature of the water plays an important role in determining one's health [14]. The accurate suitable temperature water based on the surrounding weather and humidity condition, cause the role to determine the skin health and the overall health. The system can be built with the servo valve controls [15] to the constant temperature hot and cold water inlet supply and based on the surrounding temperature and weather conditions as shown in Fig 4. The health benefits with the optimum temperature water for bath helps to gain the proper health and the good immunity of the health with the maintenance of the good skin health [16-17].
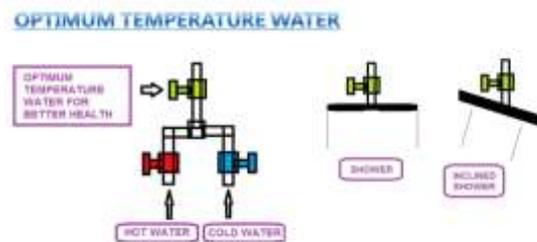

Fig 4: Optimum Temperature Water System

2.3 Restriction of Mold Growth

The improper ventilation, moisture content, vapors of the hot water, will cause the growth of the mold on the floor or walls of the bathroom [18]. This may lead to the improper maintenance of hygiene in the bathroom and cause allergies to the human. The mold growth is restricted by using the temperature and humidity sensor [19] to detect the values of the temperature and moisture in the bathroom and insists to turn on the exhaust fan in the bathroom, to exhaust the moisture and the vapor in the room and enhance that proper ventilation is provided within the bathroom. The switching of the exhaust fan to the on and off state can be controlled with the temperature and moisture sensor inputs to a

microcontroller and the necessary action is done by considering the threshold value of the inputs from sensor.

2.4 Smart Shower

The other feature of this includes the smart shower which controls the movement of shower and flow of water based on the distance of a human. The flow of water depends on the human presence at a shower. It is based on basic human ergonomics. This system of smart shower can eventually save the water. The distance of the human to the shower is measured with a waterproof ultrasonic sensor, [20] calculates the distance and based on this the flow of water is controlled and ensures that a comfortable bath is assured and the design is shown in Fig 5. Another feature of shower includes that shower turns on to the left and right side based on human detection by the passive infrared sensor that detects the human motion. Thus this ensures that the safe and hygienic bath is ensured with good water flow and proper water-saving principle.
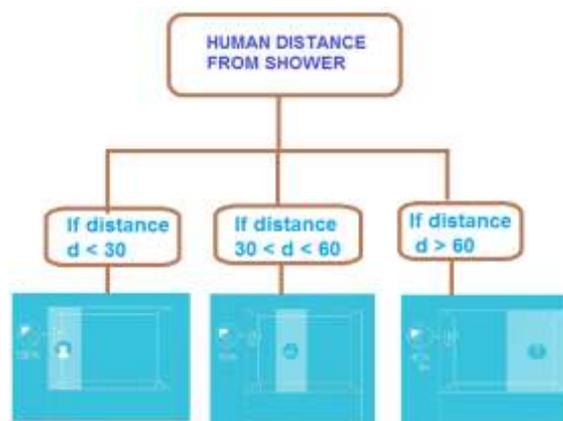

Fig 5: Block Diagram of Smart Shower System

III. Experiment and Result

The entire system is controlled with a microcontroller [21]. In this design, various sensors are connected to microcontroller and function according to the program written.

The PIR sensors are placed in such a manner that the entire space of the bathroom is covered and sensors will be continuously detecting the human presence in the bathroom. When there is no motion for a few minutes in the bathroom, the alarm turns on to alert. The entire system is managed to run only when the door is locked from inside. This reduces the accidents caused in the bathroom and provides safety.

The control of the valves is done based upon the temperature reading from the DHT sensor. The valves of cold and hot water are adjusted in such a way that the optimum temperature

water suitable for a bath is provided. The bath with this water ensures good skin health, which promotes overall health benefits.

The other feature of this system includes mold growth prevention. In this system, the growth of the mold is prevented by the sensor reading of the DHT sensor. The humidity present in the bathroom is taken from the DHT sensor and the exhaust fan is turned on eventually, to remove the humidity content present in the bathroom. The switching of the exhaust fan is done when the humidity content in the bathroom reaches the threshold value.

The last but the comfortable feature of this system includes the smart shower. The movement of the shower is done based on the PIR sensor value readings obtained to the microcontroller. When the PIR is high, that is some motion is detected, the shower is turned on to the side of the PIR sensor.

The entire system is connected to the battery to obtain the power supply as shown in Fig 6. The system can also be connected to the solar panel to have a continuous power supply, without any delay.
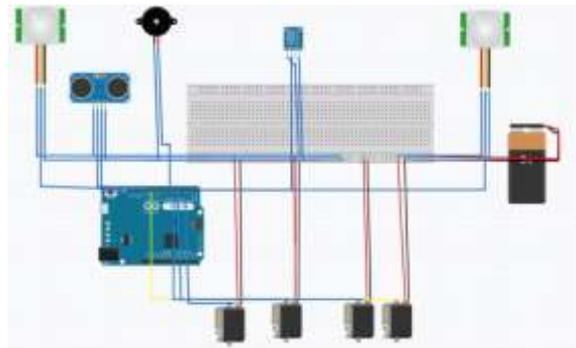

Fig 6: Circuit Design of Working Prototype

The entire system is built in the form of a prototype to design all the features in a real-time scenario. The prototype consists of valves to control the flow of the hot and cold water. The valves are connected to servo motors, to control the water flow based on the controller instructions. A pair of PIR sensors is used in the prototype to detect human motion in the range of the prototype model.

 Another valve is maintained at the outlet to control the water flow and enhances that the amount of water coming out depends on the distance detected by the ultrasonic sensor, which is present in front of the shower. The DHT sensor is present at the top to calculate the humidity and the temperature in the region of the bathroom. The design of the prototype is shown in the Fig 7.

IV. CONCLUTION

The prototype is ensured to provide comfort, safety, and hygiene to the humans in the bathroom. The entire system is built in such a way that it is suitable for young, old, impaired people and newborn babies. The maintenance of good skin health that constitutes overall health and accidents in the bathroom like unconsciousness, heart attacks can be prevented. This model ensures that safety with comfort to the modern man along with a hygienic bath, with effective working and efficient functioning.

References

1. Kepski, M. and Kwolek, B., 2014, January. Fall detection using ceiling-mounted 3d depth camera. In *2014 international conference on computer vision theory and applications (VISAPP)* (Vol. 2, pp. 640-647). IEEE.
2. Murphy, J.L. and Steffen, A.M., 2009. Improving Bathroom Safety Among Community Dwelling Older Adults. *Psi Chi Journal of Undergraduate Research*, *14*(3).
3. Kim, G.B., 2006. Change of the Warm Water Temperature for the Development of Smart Healthcare Bathing System. *Korean Chemical Engineering Research*, *44*(3), pp.270-276
4. Den Berg, V. and Volkens, H.H., Kreatech Biotechnology BV, 1994. *Apparatus for cyclincial temperature process with automatic monitoring and adjusting of the temperature of a water bath*. U.S. Patent 5,302,347.
5. Hardin, B.D., Kelman, B.J. and Saxon, A., 2003. Adverse human health effects associated with molds in the indoor environment. *Journal of Occupational and Environmental medicine*, *45*(5), pp.470-478.
6. Gören, S., Tıraşçı, Y. and Üzün, İ., 2005. The retrospectıve evaluatıon of deaths ın bathroom. *Turkish Journal of Forensic Medicine*, *19*(1), pp.29-32.
7. Cowie, B., 1976. The cardiac patients perception of his heart attack. *Social Science & Medicine (1967)*, *10*(2), pp.87-96.
8. Bujnowski, A., Palinski, A. and Wtorek, J., 2011, September. An intelligent bathroom. In *2011 Federated Conference on Computer Science and Information Systems (FedCSIS)* (pp. 381-386). IEEE.
9. Wiens, D.E., WEINS DONALD E and WIENS DONALD E, 1993. *Apparatus and method for a water-saving shower bath*. U.S. Patent 5,206,963.
10. Zhang, Z., Ishida, S., Tagashira, S. and Fukuda, A., 2019. Danger-pose detection system using commodity Wi-Fi for bathroom monitoring. *Sensors*, *19*(4), p.884.
11. Kumar, V., Yeo, B.C. and Lim, W.S., 2020. Fall Detection with Support Vector Machine for Elderly Care using Pressure Sensor Grid. *Journal of Engineering and Applied Sciences*, *15*(2), pp.636-642.
12. Nakashima, S., Kitazono, Y., Zhang, L. and Serikawa, S., 2010. Development of privacy-preserving sensor for person detection. *Procedia-social and behavioral sciences*, *2*(1), pp.213-217.
13. Data Sheet – PIR SENSOR

14. Medves, J.M. and O'Brien, B., 2004. The effect of bather and location of first bath on maintaining thermal stability in newborns. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*, *33*(2), pp.175-182.

15. Data Sheet – SERVO MOTOR (MG-995)

16. Seki, T., Morimatsu, S., Nagahori, H. and Morohashi, M., 2003. Free residual chlorine in bathing water reduces the water-holding capacity of the stratum corneum in atopic skin. *The Journal of dermatology*, *30*(3), pp.196-202.

17. Stevenson, A.H., 1953. Studies of bathing water quality and health. *American Journal of Public Health and the Nations Health*, *43*(5_Pt_1), pp.529-538.

18. Krus, M., Lengsfeld, K., Holm, A. and Sedlbauer, K., Minimum ventilation requirements for buildings from the mould point of view.

19. Data Sheet – TEMEPERATURE AND HUMIDITY SESNOR (DHT 11)

20. Data Sheet – ULTRASONIC SENSOR (HC-SR04)

21. Data Sheet – MICROCONTROLLER ARDUINO UNO (ATmega328p).

22. Taniguchi, D., Taniguchi, M., Wang, Z. and Meng, L., 2014, March. A toilet danger detection system for aged people. In *2014 International Electrical Engineering Congress (iEECON)* (pp. 1-4). IEEE.