part of the world. However, the system only works in indoor conditions.

Desai and Toravi [13] designed a smart home and heartbeat monitoring system using a wireless sensor network (WSN). The system used Spartan 3 with FPGA architecture for parallel data computation. All the sensors are connected with a microcontroller and an LCD shows the result provided by the MCU. However, all the components of the system are not embedded in a single device.

7. DISCUSSION AND RECOMMENDATION FOR FUTURE DEVELOPMENT

The summary of this review is done based on some criteria such as feedback devices, major hardware components, uses, and cost-effectiveness. Different frameworks employ different feedback systems. The summary of the reviewed system is depicted in Table I with the aforementioned criteria.

The system designed used a raspberry pi as MCU and the Lo-Ra module for data transmission and detection of hearing problems, headache, and rapid pulse rate, and used RFID tags for security and ZigBee for data transmission. It detects heart problems and body temperature [18, 19]. Some scholars discussed that an accelerometer, a voice sensor, and a microphone have been used for detecting the hyper-functional disorder and the system detected cardiovascular disease through ECG and heart rate sensor [22, 23]. The system discussed used a pulse oximeter, blood glucometer, and accelerometer for detecting chronic disease progression and used a Wi-Fi module for data transmitting [4, 5]. It detected various chronic diseases and used RFID for the security system. Electrode pads were used for detecting cardiovascular disease in the system [6]. The Arduino Uno based system has been used to detect hypothermia [25]. The system introduced used a mobile app and glucometer for detecting diabetes mellitus [26]. The high-cost device detected heart diseases [9]. Smartphone, laptop, VGA display have been used as a feedback device [10]. The system detects abnormalities in the heart. The respiration rate was monitored by using a respirator and accelerometer [12]. The system used various gas sensors to provide the health monitoring facility [13].

Though extensive works have been done to implement smart healthcare systems that are summarized in this paper, various sensors can be employed for health system monitoring for further development. The future developed systems can employ Wi-Fi and IR sensors to overcome the range limitations of Bluetooth devices. Smartphones can be used as a health monitoring system as it makes the interaction between multiple sensors very easy. Various machine learning algorithms can be used to make the systems more accurate. In microcontroller-based systems, raspberry pi can be used for easy presentation of the monitoring data on websites.

8. CONCLUSIONS

In this review, the use of IoT in health monitoring systems has been summarized. Although IoT is being used in all sectors of medical science, there is room for further improvement and research. The early identification of any health problem can help the patient to take necessary emergency measures, which can potentially save the patient's life. IoT can help in this regard. IoT based health monitoring systems can monitor the patients in real-time and warn the patient of any abnormalities. However, the IoT architecture must have the facilities to ensure the proper security of sensitive data. Also, the used sensors must be small in size so that they can be easily incorporated into various systems. Finally, the use of various machine learning and deep learning algorithms might make the systems more accurate and robust. The idea of a smart health monitoring system using the IoT architectures is a novel contribution in the field of medical science and it will reduce health issues and unwanted deaths.

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