A Survey on Prediction of Cardiac Arrest using Machine Algorithm

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***Abstract*- Person should wear a accessories which is having a features of detecting human health condition, like smart watches, bands, small devices can be attached your body somehow, which helps us to predict heart disease, or sense of cardiac. Once he detects through that device, that human should be able to find nearby hospital the one which is having heart specialist. Next suppose worst case if that specialist is not available that person should be able to get medicine related to heart disease.**

Effective patient treatment plan prediction is a complex task because using body sensor, networks generate a vast amount of data of enormous number of people that need to be stored for data analysis for dynamically predict the treatment plan for individuals. Realistic patient data from various hospitals can be managed and predicted through Machining Learning Algorithm.

***Keywords*- Embedded control system, ARM, Robot control system, QT.**

I. INTRODUCTION (HEADING 1)

Gadget mastering (**ML**) is a sub-class of synthetic intelligence that refers to the technique by which computer systems increase sample popularity, or the potential to continuously study from and make predictions based totally on records, then make modifications without being particularly programmed to achieve this.

No. The term "heart attack" is often mistakenly used to describe cardiac arrest. While a heart attack may cause cardiac arrest, the two aren't the same. Heart attacks are caused by a blockage that stops blood flow to the heart. A heart attack refers to death of heart muscle tissue due to the loss of blood supply. It's a "circulation" problem. A heart attack is quite serious and sometimes fatal. By contrast, cardiac arrest is caused when the heart's electrical system malfunctions. The heart stops beating properly. The heart's pumping function is "arrested," or stopped. In cardiac arrest, death can result quickly if proper steps aren't taken immediately. Cardiac arrest may be reversed if CPR is performed and a defibrillator shocks the heart and restores a normal heart rhythm within a few minutes. Cardiac arrest may be caused by irregular heart rhythms called arrhythmias. A common arrhythmia associated with cardiac arrest is ventricular fibrillation. In ventricular fibrillation, the heart's lower chambers suddenly start beating chaotically and don't pump blood. **The objective of this study is to present a multisensory system using IoT that can collect physical activity heart rates and body temperatures**. **For this study, we implemented an embedded sensory system with a Low Energy Bluetooth communication module to discreetly collect electrocardiogram and body temperature data using a smart phone in a common environment. This study introduces the use of signal processing and machine learning techniques for sensor data analytics for sudden cardiac arrest and or heart attack prediction.**

II. LITERATUE REVIEW

Cardiac Arrest Prediction using Machine Learning Algorithms[1]:*In this Paper we are applying SVM, RF,DT,logistic regression and ANN to predict the occurrence of cardiac arrest in patients it is found out that the accuracy of artificial neural network* is the highest (~85 %). Also, since the dataset was **limited, the accuracy of the algorithm is low.**

This novel approach Mobile Devices and Apps for Health Care Professionals: Uses and Benefits [2] giving an idea of using mobile devices can have many medical software applications. Numerous apps are now available to assist HCPs with many **important tasks**, such as: information and time management; health record maintenance and access; communications and consulting; reference and information gathering; patient management and monitoring; clinical decision-making; and medical education and training.

I have extracted information related to smart devices like detecting health status of a human RFID and IoT in a smart hospital[3] : benefits and challenges, Smart patient tracking is a bright example of how **RFID** and IoT help in the healthcare environment by assisting in improving services.

This assessment giving me an information of how to diagnose and predict heart attack or cardiac arrest. A Comparative Assessment Study on Machine Learning Classifiers for Cardiac Arrest Diagnosis and Prediction, **Heart attack[4], also known as cardiac arrest,** encompasses various heart-related disorders and has been the leading cause of death worldwide in recent decades. The **investigated model** will be **tested** on a **new heart disease dataset** in the **future**, and the investigated model will be deployed on a website for people to avail the chance of predicting their likelihood of getting cardiac arrest.

In their work early detection of cardiac arrest using Machine Learning [5], Target—Most of the Cardiac Arrest (CA) cases are preventable because the CA patients usually had **abnormal clinical signs or symptoms before their suffering from CA.** their contribution in predicting CA and CPR event before it occurred around 3 to 3.5 hours in advance, and it is similar to that of the state-of-the-art such Early Warning Score (EWS) with around 3.5 hours. In addition, avoiding the problem of dataset imbalanced may effectively improve the accuracy of predicting CA as well.

These authors have predicted cardiac arrest as early through IoT [6]. Wireless Early Prediction System of Cardiac Arrest through IoT, The objective of this study is to present a multisensory system using IoT that can collect physical activity heart rates and body temperature.

These authors have worked on Machine learning model for predicting out-of-hospital cardiac arrests using meteorological and chronological data [7]. Objectives To evaluate a predictive model for robust estimation of daily out-of-hospital cardiac arrest (OHCA) incidence using a suite of machine learning (ML) approaches and high-resolution meteorological and chronological data.

The machine learning horizon in cardiac hybrid imaging [34], Machine learning (ML) represents a family of algorithms that has rapidly developed within the last years in a wide variety of knowledge areas.

Machine learning as a supportive tool to recognize cardiac arrest in emergency calls [8], Emergency medical dispatchers fail to identify approximately 25% of cases of out of hospital cardiac arrest, thus lose the opportunity to provide the caller instructions in cardiopulmonary

resuscitation. We examined whether a machine learning framework could recognize out-of-hospital cardiac arrest from audio files of calls to the emergency medical dispatch center.

Machine learning can support dispatchers to better and faster recognize out-of-hospital cardiac arrest during emergency calls: A retrospective study [13], ML recognized a higher proportion of OHCA within the first minute compared with dispatchers and has the potential to be a supportive tool during emergency calls. The optimal FPR settings need to be evaluated in a prospective study.

Description of call handling in emergency medical dispatch centres in Scandinavia: recognition of out-of-hospital cardiac arrests and dispatcher-assisted CPR [14], We observed variations in OHCA recognition in 71-96% and dispatcher assisted-CPR were provided in 50-80% in NO-CPR_{prior} calls. In cases where CPR was initiated prior to emergency calls, dispatchers were less likely to start CPR instructions but provided quality assessments during instructions.

Machine Learning for Early Detection of Hypoxic-Ischemic Brain Injury After Cardiac Arrest [15], Deep transfer learning used to evaluate normal-appearing findings on HCT scans obtained early after ROSC in comatose survivors of cardiac arrest accurately identifies patients who progress to show radiographic evidence of HIBI on follow-up HCT scans.

Machine learning for early prediction of in-hospital cardiac arrest in patients with acute coronary syndromes [16], The XG Boost model, which was generated based on a machine learning algorithm, has high potential to be used to predict cardiac arrest in ACS patients. This proposed model significantly improves outcome prediction compared to existing risk prediction scores.

An intelligent warning model for early prediction of cardiac arrest in sepsis patients [17], We illustrated that machine learning techniques, especially ensemble algorithms have high potentials to be used in prognostic systems for sepsis patients. The proposed model, in comparison with the exiting warning systems including APACHE II and MEWS, significantly improved the evaluation criteria. According to the results, the time series dynamics of vital signs are of great importance in the prediction of cardiac arrest incidence in sepsis patients.

Decision tree model for predicting in-hospital cardiac arrest among patients admitted with acute coronary syndrome [18], Our objective was to develop and validate a simple clinical prediction model to identify the IHCA risk among cardiac arrest (CA) patients hospitalized with acute coronary syndrome (ACS). **Hypothesis:** A predicting model could help to identify the risk of IHCA among patients admitted with ACS.

A machine learning based model for Out of Hospital cardiac arrest outcome classification and sensitivity analysis[35] , ML modeling of the complex Chicago OHCA rescue system can predict neurologic outcomes with a reasonable level of accuracy and can be used to support intervention decisions such as CPR or coronary angiography.

Accuracy of Machine Learning Models to Predict In-hospital Cardiac Arrest: A Systematic Review [20]. The ML models presented in this systematic review demonstrate a novel approach to predicting IHCA. All included studies suggest that ML models had similar or better predictive performance compared with MEWS. However, there is substantial variability in performance measures and concerns for risk of bias.

Predicting the Mortality and Readmission of In-Hospital Cardiac Arrest Patients With Electronic Health Records [21]: A Machine Learning Approach, **Conclusions:** This study demonstrated the potential of predicting future outcomes for IHCA survivors by machine learning. The results showed that our proposed approach could effectively alleviate data imbalance problems and train a better model for outcome prediction.

An Android based Application for Determine a Specialized Hospital Nearest to Patient's Location [22], **The** future scope of this application is to develop and determine the availability of specialist doctor on a real-time basis near patient's location. This development will also give an opportunity to book online appointment which facilitates the patients by saving the time.

The Use Of RFID Technology In The Patient Tracking System [23], The purpose of this thesis was to analyze the barriers, challenges, advantages, and disadvantages of using RFID in patient tracking system.

Heart Attack Prediction System Using IoT and Machine Learning [24], ***health diseases*** *are increasing day by day due to lifestyle, hereditary. Especially* ***heart attack*** *has become more common lately, i.e., the life of people is at risk.*

IoT in Healthcare: Devices Care and Technology [25], IoT technology keeps patients better connected to doctors via remote monitoring and virtual visits;

Application of wearable health devices in the field of health care: A narrative review [26],

Bio-Multifunctional Smart Wearable Sensors for Medical Devices [27], Considering that most laboratory-on-a-**chip testing tools**, health-care monitoring devices, and **wearable electronics** can be expected to come into contact with the human skin, organ, and tissue interfaces, the bio functionality of **flexible sensors is very important for improving man–machine interactions and enhancing the safety, reliability, and stability of tests**. In this review paper, we detailed and discussed **smart wearable sensors, focusing on bio functionality**, such as biocompatibility, biodegradable, and self-healing. In particular, **different wearable sensors for vital sign monitoring** (biophysical, biochemical, and environmental signals) were discussed, whereas the **advantages of bio-multifunctional sensors** for use in wearable medical devices are presented. These applications are in fields where there is a demand for biocompatibility, safety, accuracy, mechanical flexibility, high sensitivity, reproducibility, and stability. As the range of functionalities of **flexible and wearable sensors is continuously growing,** the identification of **novel wearable sensors that can fulfill the demands of medical applications** is highly desired. Although multifunctional wearable sensors have made tremendous progress, they still respond to multiple stimuli at the same time, which makes the device very sure of the intensity and type of each stimulus. Therefore, the study of wearable sensors with low cross sensitivity and high recognition is a direction of the future development of flexible electronics. **Another challenge** is fabricating smart multifunctional sensors by developing new material to provide a robust sensing platform, such as the development of wearable devices with bio functionality to copy the characteristics of the human skin and make smart devices work in harsh environments. We hope that this work will convince readers that with the further development of smart wearable sensors coupled with bio-functionalities, the promise of bioelectronic devices and their applications in medical diagnosis and treatment is limitless.

Wearable Devices for Environmental Monitoring in the Built Environment: A Systematic Review [28] , The so-called Internet of Things (IoT), which is rapidly increasing the number of network connected and interconnected objects, could have a far-reaching impact in identifying the link between human health, well-being, and environmental concerns. In line with the IoT concept, many **commercial wearable's** have been introduced in recent years, which differ from the usual devices in that they use the term "smart" along side the terms "watches", "glasses", and "jewellery". Commercially available wearable's aim to enhance smart phone functionality by enabling payment for commercial items or monitoring physical activity.

Wearable Health Devices in Health Care: Narrative Systematic Review [29], **Objective**: Although previous reviews have discussed consumer trends in wearable electronics and the application of wearable technology in recreational and sporting activities, data on broad clinical usefulness are lacking. We aimed to review the current application of wearable devices in health care while highlighting shortcomings for further research. In addition to daily health and safety monitoring, the focus of our work was mainly on the use of wearable devices in clinical practice.

A New Wearable System for Sensing Outdoor Environmental Conditions for Monitoring Hyper-Microclimate [30], This paper presented a new wearable device that monitored several environmental parameters related to the air quality in the thermal and visual domains on a hyperlocal scale. The system performed counts with a GPS that associated a precise geographic position to each measurement, allowing detecting the intra-urban variations of all the factors it measured. This **wearable device is also helpful for microclimate** monitoring in historical cities and protected and sensitive areas, where monitoring systems based on vehicles cannot accede to some streets.
Wearable and fully printed microfluidic nano sensor for sweat rate, conductivity, and copper detection with healthcare applications
Smart wearable devices in cardiovascular care: where we are and how to move forward [31], Understanding the **triggers and barriers of wearable devices requires close collaboration** between medicine and technology as well as knowledge of how the technology will be adopted and accepted through different stakeholders, from clinicians to regulatory bodies to users.

Wearable Devices for Ambulatory Cardiac Monitoring: JACC State-of-the-Art Review [32], Ambulatory monitoring devices are enabling a new paradigm of health care by **collecting and analyzing long-term data for reliable diagnostics**.
Wearable Devices in Medical Internet of Things: Scientific Research and Commercially Available Devices [36], ***Wearable devices are now used for a wide range of healthcare observation. One of the most important elements essential in data collection is the sensor. During recent years with improvement in semiconductor technology, sensors have made investigation of a full range of parameters closer to realization.***
Self-medication and non-doctor prescription practices in Pokhara valley, Western Nepal: a questionnaire-based [37], study, ***Conclusions, Self-medication and non-doctor prescribing are common in the Pokhara valley. In addition to allopathic drugs, herbal remedies were also commonly used for self-medication. Drugs, especially antimicrobials, were not taken for the proper duration. Education to help patients decide on the appropriateness of self-medication is required.***

Utility of a novel wearable electrode embedded in an undershirt for electrocardiogram monitoring and detection of arrhythmias[33], *The usefulness of a novel electrode embedded in an undershirt is equivalent to that of a Holter ECG in monitoring the ECG and detection of arrythmias.*
ESC working group on e-cardiology position paper: **use of commercially available wearable technology for heart rate and** activity tracking in primary and secondary cardiovascular prevention—in collaboration with the European Heart Rhythm Association, European Association of Preventive Cardiology, Association of Cardiovascular Nursing and Allied Professionals, Patient Forum, and the Digital Health Committee,
Smart wearable body sensors for patient self-assessment and monitoring [12], **Conclusion:** Although these devices have been shown to be accurate and have clinical utility, they continue to be underutilized in the healthcare industry. Incorporating smart wearable sensors into routine care of patients could augment physician-patient relationships, increase the autonomy and involvement of patients in regards to their healthcare and will provide for novel remote monitoring techniques which will revolutionize healthcare management and spending.

The Use of Smart Devices by Care Providers in Emergency Departments [8]: Cross-Sectional Survey Design- 2019 Jun, ***Conclusions:The findings of this study make it imperative to ensure the safety and wellbeing of patients, especially in high intensity, high volume departments like the ED. Irrespective of the positive role SDs play in the health care process, the negative effects of their use mandate proper regulation, in particular, an ethical mandate that takes into consideration the significant consequences that the use of SDs may have on care processes and outcomes.***

IoT-Based Applications in Healthcare Devices [38] - March 2021, e current review investigated different aspects of the HIoT system. Comprehensive knowledge about the architecture of an HIoT system, their component, and the communication among these components has been discussed herein. Additionally, this paper provides information about the current healthcare services where the IoT-based technologies have been explored. By employing these concepts, the IoTtechnology has helped healthcare professionals to monitor and diagnose several health issues, measure many health parameters, and provide diagnostic facilities at remote locations. +is has transformed the healthcare industry from a hospital-centric to a more patient-centric system. We have also discussed various applications of the HIoT system and their recent trends. Further, the challenges and issues associated with the design, manufacturing, and use of the HIoT system have been provided. +ese challenges will form a base for future advancement and research focus in the upcoming years. Moreover, a comprehensive up-to-date knowledge on the HIoT devices has been provided for the readers who are not only willing to initiate their research but also make advancements in the said field.
A Smart Sensing Architecture for Domestic Monitoring: Methodological Approach and Experimental Validation-17 July 2018 [39], Conclusions: In this paper, the authors present the design and implementation of a smart communication architecture for user monitoring inside a domestic environment developed with an extensive partnership. The authors propose an innovative idea of an interoperable embedded intelligent system, where several simple and low-cost smart devices, both health sensors (Physio Kit) and home automation sensors (Home Kit), are used to monitor the general health status and the behaviors of elderly people. The chosen sensors are easy to use and non-invasive so that they can be easily accepted by an elderly person. One of the main innovative aspects of our proposed architecture with respect to the existing ones is the user interaction with the architecture in order to perform biomedical measurements. As for the hardware, in addition to the sensors, the project includes the use of a gateway as well as a smart device (i.e., a tablet) to display the App that interacts with the sensors. In addition, the App has been designed to be user-friendly, easy to use and acceptable to elderly users. In fact, one of the major problems encountered in AAL monitoring systems is precisely the non-acceptance or the inability to use the system itself by the user, especially when dealing with the elderly. The main goal that AAL systems must accomplish is to ensure the persons' welfare, without, however, compromising the dignity of the person. Hence, extreme attention has been taken into account by the authors to this aspect of the system and, in this work, the authors propose an active approach to maintain the Service Bridge as transparent as possible, which means that user interactions are kept to the minimum required. An Android box has been installed in some apartments, which hosts the home automation service that communicates directly with the Service Bridge without the need of sending a command to start the biomedical parameters acquisition. In this way, the acquisition can be conducted by the user, without the need to interact with the Health App or, in any case, only for data visualization. Sensors 2018, 18, 2310 19 of 22 In any case, a period of user training was necessary, which lasted approximately one month, since the combination of innovative technologies and elderly people requires time and efforts. The main target of the project was the development and the implementation of the software architecture taking into account in particular its modularity, scalability and extendibility, so the authors have decided to use an OSGi framework. The performance analysis of a system connected to many smart homes is another common problem of AAL monitoring systems, thus the use of a scalable architecture for storage, analysis, and sharing of many data is necessary. Moreover, the OSGi framework enables the integration of **new sensors in a plug and play mode**, only developing a new set of bundles without modifying the software architecture. The feasibility and appropriateness of the proposed architecture and technologies in the creation of a low cost and flexible system has been successfully evaluated through an extensive experimentation. The entire hardware and software architecture was installed in eight apartments. Data from biomedical and home automation sensors were collected

in the App and then sent to the Cloud where machine learning algorithms were used for the user behaviors identification and data analytics to finalize services for the elderly community. Experimentation has highlighted the stability of the novel adopted architecture and allowed obtaining some very promising preliminary results about two aspects: inter-subject classification, and intra-subject classification. In the first case, the classification of different house profiles using the combination of all features (both home automation and health) allows the discrimination of different house scenarios with high accuracy (mean ± std = 0.99 ± 0.01) and macro-F1 score (mean ± std = 0.99 ± 0.01). Moreover, an unsupervised approach was made to annotate data on which to carry out more in-depth studies in the future (e.g., PIR sensors will be used with the information of the timestamp to study user's paths inside the house). In particular, in the second study case, the authors used home automation data to predict and distinguish normal and abnormal behavior. The machine learning algorithm learns the alert/normal condition from the clustering of health data and the results are very promising, especially when the person lives alone (i.e., macro-F1: mean = 0.64, 95% CI = (0.548, 0.732), t9 = 3.44, $p < 0.01$). In the future, these machine learning algorithms could be used on the collected data to generate alarms when the activities carried out by the user and monitored by home automation sensors deviate from the typical normal behavior of the user. This could be a good solution for those elderly people who live alone and are not continuously assisted, as these alarms could be sent to a family member or a caregiver to alert her/him of a possible problem. In this way, the system could ensure an automatic management of alarms and allow detecting relevant information that cannot be inferred from data visualization.

Smart healthcare support for remote patient monitoring during covid-19, quarantine 2020 [12], The application of Internet of Things in smart home automation has led to a great deal of improvement in convenient living, remote access to home appliances, mobile health care and improved social lifestyle primarily for senior citizens. Combining home automation with the healthcare system helps alleviate stress, reduces the cost of living and gives room for remote communication between doctors and patients. In this work, we have proposed a smart home health care system for the sick, elderly and handicapped. The current work was focused mainly on making life more convenient for those with health challenges who need to visit the hospital regularly. The new system has been developed in order to reduce the number of hospital visits, queues in the hospital and reduction in the cost of taking care of the sick. The system performs a dual role of both health monitoring and control of essential home appliances; with this, users can enjoy social life and still have their health managed and monitored especially during an era of the pandemic. The proposed method will have a great impact on the quality of life by reducing the transmission rate of communicable diseases. Patients diagnosed and under treatment for a disease such as COVID-19 will not have any cause to move about frequently and thus, quality of life is ensured and transmission rate is reduced. The on-going phase of the current system is its physical deployment with IoT devices, a testing phase of the mobile application using the real-world scenario and documentation of feedbacks for improvement.

It is recommended that after rigorous testing and evaluation, the proposed system can be deployed in hospitals for use in various units. The designed mobile and web application, once fully developed, can be plugged into existing web domains of hospitals as a portal and can be launched as a fresh application for hospitals without existing domains. It is also recommended that new features such as a physiological data capturing device be incorporated into the current system.

The goal of the IoT is to enable things to be connected anytime, anyplace, with anything and anyone ideally using any path/network and any service [3]. This goal requires more development in many areas including communications and applications. Many research and development entities are involved in development activities. Cisco defines the Internet of Everything (IoE) as connectivity of people, data, things, and processes in networks of connections [3]; in other words, IoE is a network of computers and devices of all types and sizes, all Communicating and sharing information. Cisco [4] also predicts there will be 50 billion devices connected to the Internet by 2020. IoT can be described as a network of networks.

III. OUTCOME OF SURVEY

Person will be wearing smart watches through IoT technology can predict person is facing some heart problem, through IoT technology can find near by hospital and doctor availability, If doctor is not available first aid treatment must be known to nurse staying in hospital .

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