An adaptive Medical Cyber-Physical System for post diagnosis patient care using cloud computing and machine learning approach

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Abstract—**Medical care is one of the most basic human needs. Due to the global shortage of doctors, nurses, and other healthcare personnel, medical cyber-physical systems are quickly becoming a viable option. Post-diagnosis surveillance is an essential application of these systems, which can be performed more successfully using various monitoring devices rather than active observation by nurses in their physical presence. However, most existing solutions for this application are rigid and do not consider current difficulties. Intelligent and adaptive systems can overcome the challenges because of the advances in relevant technology, especially healthcare 4.0. Therefore, this work presents an adaptive system based on cloud and edge computing architecture and machine learning approaches to perform post-diagnosis medical tasks on patients, thus reducing the need for nurses, especially in the post-diagnosis phase.**

Index Terms—**cyber physical system, medical cyber physical system, healthcare 4.0**

I. INTRODUCTION

The term "smart world" refers to a scenario in which the physical world is continuously connected to sensors, actuators, digital displays, and computing devices that are seamlessly integrated into everyday things and connected through an interconnected network [1]. The top five research areas dedicated to achieving this smart society are the Internet of Things, Wireless Sensor Networks, Mobile Computing, Pervasive Computing, and CPS [2]. The President's Council of Advisors on Science and Technology (PCAST) has identified CPS as a top priority for government research funding [3].

A Cyber-Physical System (CPS) combines computing, including the cyber world, and physical processes through computer networks. In addition, computers and networks integrated into physical processes are utilized to monitor and govern them via feedback loops [4]. One of the various fields in the field of CPS is Medical Cyber-Physical System (MCPS)

[5]. MCPS is a networked, intelligent, safety-critical system for medical equipment. Previously, clinical settings might be considered closed-loop systems, with caregivers acting as controllers, medical equipment acting as sensors and actuators, and patients acting as "plants".

People's biggest concern these days is health care. Chronic diseases such as type 2 diabetes, kidney disease, and nutritional problems are common. These patients should be examined and treated at regular intervals to avoid major problems. In urgent cases, the patient also needs the presence of physicians and clinical assistants. Unfortunately, many patients do not receive adequate care. One of the most common reasons is the lack of physicians. In rural or remote areas, there are few doctors, and the hospitals may have unqualified nurses [6]. To provide adequate treatment, doctors must be present in the hospital almost all the time. Nurses must also be well trained and responsible for monitoring patients after diagnosis. Even then, mistreatment is possible. So modern technology needs to be improved. In this study, we examine a situation in which physicians are not always present in the hospital and patients are not always seen and treated by nurses. The proposed system would change treatment decisions and activities depending on sensor data. The goal is to design a system that can decide whether or not to treat a patient based on a collection of data. To achieve this goal, sensors and actions must be identified for various medical problems. It will also reduce post-diagnosis monitoring situations that rely on nurses.

This paper discusses various MCPS discussed in previous research articles and proposes a new model. This paper is divided into five sections. Section 1 is for the introduction, which discusses the rationale and objectives of the research. Section 2 summarizes other existing research. The third section