

6th International Conference on Engineering Technology and its Applications 2023- (6thIICETA2023) IoT System of medical equipment monitoring and ambulance tracking

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Abstract—With the rapid development in the field of information and communication technology, taking advantage of this development has become an urgent necessity in most areas such as the military, engineering, agriculture, and health life. The developers have provided an appropriate environment that accommodates most of these areas, which take on responsibility for looking for speed of implementation, speed of access, remote management, and other features that are in high demand and need. This paper introduces one of the important applications in the field of the *Internet of Things (IoT)* that is related to human life and health. a smart ambulance system implemented. Patient data collected by sensors are distributed in an ambulance and continuously received at the hospital side based on cloud computing, then it is sent to the specialists to give decisions, that may help to save critical cases according to the received information and it may need quick access and intervention by them Access to the patient shortens the time, especially during peak times. The ambulance tracking is done through the navigation monitoring system.

(Keywords); Cloud computing; health care; smart ambulance Tracking, smart ambulance

I. INTRODUCTION

Cloud computing offers many services depending on consumers' demands. Which can be classified into three types, i. Infrastructure as a Service or "IaaS" involves virtual operation systems, servers, storage, and networking as the consumers need this service help to reduce the total cost to build physical systems, maintain, and allocate places.

ii. Platform as a Service "PaaS" it's the second layer of cloud computing which includes the software and tools that developers needed to build and develop an application or database iii. Software as a Service "SaaS" is a software delivery model in which software and its associated data are hosted centrally, that provides remote access to the software as a web-based service (no need to install the software to the

end user's devices). The software service can be purchased with a monthly fee or paid as you go [1].

II. CLOUD COMPUTING AND APPLICATION

Cloud computing service presents reliability, wide network access, location self-rule, application agility, voluntariness, elasticity, distribution, scalability, dynamicity, high-speed services modification, fewer capital expenses, doubts, and pooling of resources for a domain of applications The cloud computing realization is closely related to many other later developments in the field, can expand in real-time which is one of the major advantages of the cloud at variance grids, computing Resources. figure (1) shows one of the common applications based on cloud computing "healthy system"

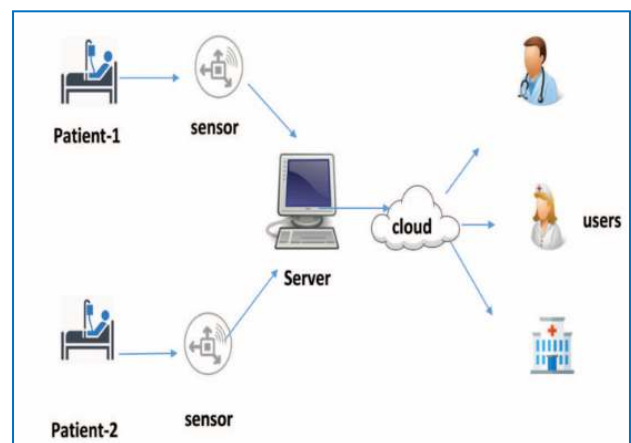


Fig (1) Healthy care system

The Internet of Things (IoT) serves as a healthcare help and is very important in a broad variety of applications for monitoring medicinal services. By analyzing the pattern of parameters that are seen, it is possible to make educated guesses about the nature of the condition. By employing

conventional ways such as wearable devices, wireless channels, and other remote equipment, specialists in the medical field and technologists have developed an amazing system that offers low-cost healthcare monitoring to patients suffering from a wide range of conditions.

The Cloud Computing system mainly includes four roles: consumer, provider, auditor, and broker.

- a) CLOUD PROVIDER: The cloud provider (or cloud service provider, CSP) is the party responsible for making the service usable to the parties interested in third parties. The cloud provider acquires and manages the processing infrastructures necessary to provide the services, ensures the execution of the programs that allow the services, and the infrastructures to deliver the services through the network.
- b) CLOUD CONSUMER: The cloud consumer (or cloud service consumer, CSC) is the main entity that uses cloud computing services. represents a person or organization that has entered into a contract with a cloud provider.
- c) CLOUD REVIEWER: The cloud auditor who can perform an independent examination of the controls carried out on the services to express an opinion on the merits.
- d) CLOUD BROKER: Integrating cloud services can reveal a complex business to conduct for the consumer cloud, especially in a rapidly changing environment such as cloud computing.

III. LITERATURE REVIEW

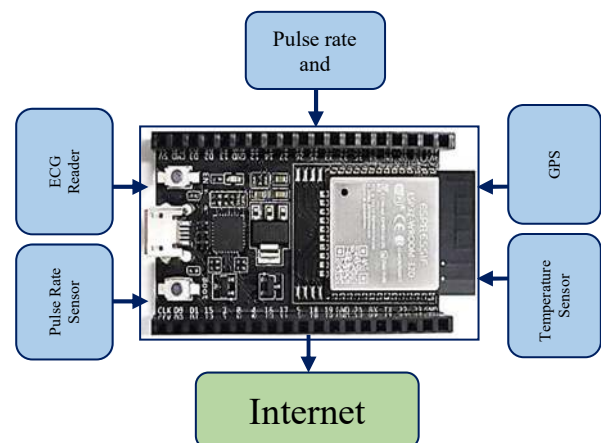
Authentications, security, and privacy are the main facilities that each user wants to be in any computing system, one of the Cloud Computing model drawbacks is vulnerabilities to the security of data. Cloud Computing has improved secured access by using some technologies and strategies. It uses data encryption and a trust management system abstracted from user authentication and authorization [2] depending on a) “Hybrid Key Generation” (HKG),

b) storage management. To improve the security cloud of health care databases [3]. due to big data being used from several resources and stored in cloud computing security issue is important to solve one of these approaches is using the technology Hadoop platform [4] with several ways to solve these problems. Cloud computing becomes more suitable, beneficial, and necessary to obtain in several fields e.g. medical, education, and sciences. Implementation of a system that can monitor and analyze human electrocardiogram (ECG) data [5]. Employ cloud computing to serve health care taking advantage of the low cost of maintenance and employment [6], and build health applications based on the clouding features of data storage, analysis, and accessibility to reach for high performance [7]. A health monitoring system that relies on several wireless sensors and the infrastructure of the system that collects data from several patients in pre-set periods. It issues an alarm via pre-set e-mail and SMS for abnormal cases and gives priority to critical cases, only authorized persons in the system allow them to access the data [8]. Another application for cloud computing by building an on-site medical system inside the hospital or home that monitors the status of several cases and sends periodic reports to the doctor supervising the case by phone using the GSM system, the system collects the data recorded through the sensors and analyzes them, as it

contributes to shortening time, cost and periodic follow-up for patients [9]. Neural Network (NN) based used to achieve computational intelligence is a powerful methodology for a wide range of pattern recognition and data analysis problems such as social media applications [10]. The health of the patient is monitored using appropriate sensors, such as P.R., fever, CO₂, and ambient temperature sensors. Medical personnel may determine what to do after getting information to study the patient's situation; the error percentage of the established scheme is under a set limit (5%) for each case. [11]. An intelligent emergency system is one of the newest applications that are used in the healthcare area, which relies on sharing information between health systems and sub-sectors, such systems improve response to emergencies [12]. Some of the influencing factors such as processing and analyzing huge amounts of data, infrastructure, and network traffic that should be taken into consideration for designing any health system with the help of IoT are discussed in [13]. In the context of this proposed work, the implementation of an ambulance monitoring system that includes real-time monitoring of human biological activities such as heart rate, temperature, and oxygen level in addition to the development of the vehicle location system may or may not be possible depending on the practical side of the situation. The data that was captured will be presented to experts in the medical area so that they may evaluate the situation, establish whether or not the case is urgent, and make the proper choice in order to provide the patient with the appropriate treatment while they are transporting him using an ambulance tracking vehicle. This issue will help to contribute significantly to a significant reduction in the aggravation that the patient is experiencing by offering guidance to a specialized physician on how to provide the staff that is accompanying the patient with treatment instructions.

IV. EXPERIMENT TOOLS

In order to build the proposed work needs to connect a number of sensors together through a chip microcontroller that can provide wireless connection as in figure (2)., power consumption, size, cost-effective, and other features of MCU ESP32 are selected depending on the above, is considered a hybrid board that contains both (Bluetooth and Wi-Fi). It is considered one of the most useful and powerful controllers. it operates with a 32Bit Dual-Core processor of “160MHz”, 36 input and output ports, “18 DAC” and a USB port [12]. It is worth-temperature tolerance of up to “125 °C”. it can program by Java, Basics, or Arduino program the Node MCU ESP32 shown in figure (2).



tracking. All the above tools are implemented on Node MCU ESP32 Wi-Fi.

Fig (2) Proposed work Diagram

- a) Temperature sensor (dht11): This sensor is less precise, smaller, and less costly. do not require any external calibration to provide typical accuracies of $\pm 1^{\circ}\text{C}$ at $+25^{\circ}\text{C}$ and $\pm 2^{\circ}\text{C}$ over the -40°C to $+125^{\circ}\text{C}$ temperature range. [11].
- b) GPS (Global Positioning System) tool: receivers featuring of high-performance positioning engines. Its flexible and cost-effective receivers offer numerous connectivity options in a miniature with design dimensions of about a "16 x 12.2 x 2.4" mm package. [14]
- c) Pulse Oximeter (SPO2) MAX30100 Heart-Rate Sensor Module: A pulse oximeter is a small, lightweight device used to monitor the amount of oxygen carried in the body.

V. PROPOSED WORK

The proposed system is made up of a vendor side and a cloud computing side. On the vendor side, the emergency unit gathers data on the patient's health status from the ambulance's medical equipment before sending it to the hospital and a specialized medical team. These teams can then decide how best to handle the situation. As shown in figure (3), cloud computing may be seen as a connection between the ambulance and hospital sides.

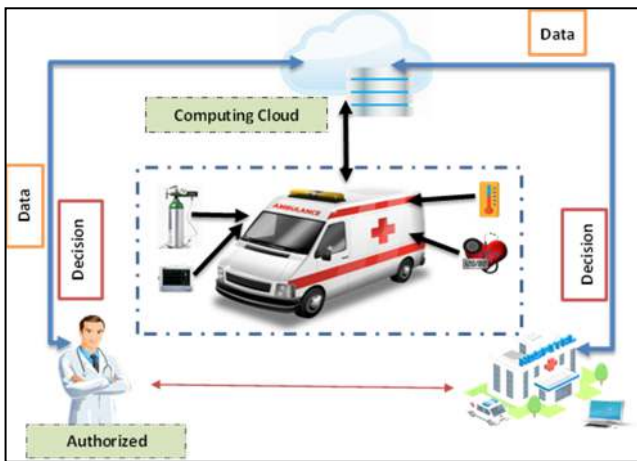


Fig (3) Proposed Cloud based System

This work focuses to achieve two goals, first one collects instantaneous healthy data about the emergency case in the ambulance vehicle included (fever, pulse rate, and oxygen rate) The tools needed to achieve this goal are (temperature sensors, heart rate, ECG reader, and oximeter), second goal Some occurrences of mortality or worsening of sickness occur during the move of an emergency case from its location to the hospital for a variety of causes. This matter should have been taken into consideration and find an appropriate solution for it by adding a tracking device that can help to facilitate vehicle

VI. RESULTS AND DISCUSSION

The first step implements hardware components with Node MCU ESP32, the second uploads all required codes libraries by ide software, access point configuration between ESP32 and router this step is shown in figure (4)

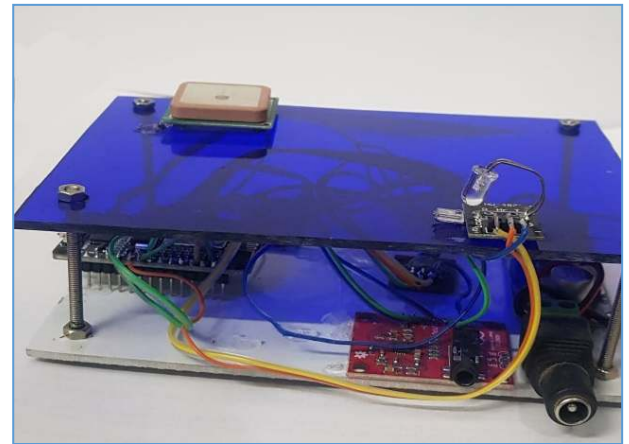


Fig (4) Hardware components board

a) Cloud Processing:

Data acquired via sensors is transferred to the cloud in preparation for presentation when requested by authorized individuals, physicians, and critical care units, for example, and the security problem must be the primary reason in preventing unauthorized persons from accessing the data.

b) Results monitoring:

Data collected by sensors is shared with the cloud so that we can get remote access whenever we need it from anywhere. To ensure security, the web page is designed to act as an interface between the cloud service and authorized users, using WordPress templates and a domain reserved for this purpose from AL-Furat Al-Awsat Technical University. WordPress sites are built using a variety of computer languages, including HTML. The page comprises an introduction, a block diagram, and a representation of the system login window (5.a). Displaying the home page For cloud servicing, a remote XY application is employed to monitor the received data from all medical equipment. Figures (5 b and c) demonstrate how a GPS sensor was fitted to track the designated ambulance. hardware structure includes all elements are connected to the mainboard MCT ESP32. The software part starts with the preparation of programming ground with Arduino software environment to define each of medical equipment, wireless connection,

and cloud computing server information then it is uploaded to MCU ESP32.

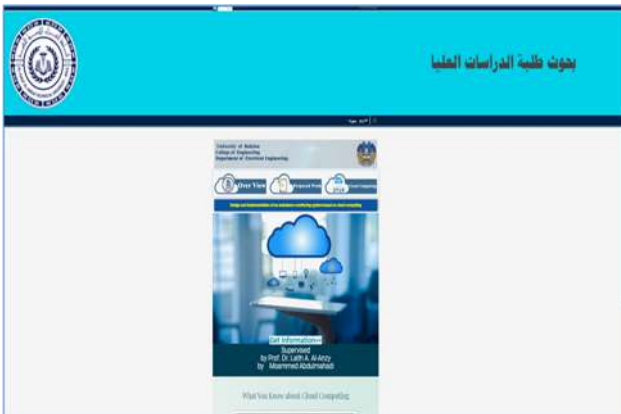
(b) Sensor monitoring (c) Vehicle Location

VII. CONCLUSION AND FUTURE WORK

Smart ambulance introduced in this paper, help to improve the health departments, and it proved a big database about each patient, time is the main critical issue with emergency case especially in wars and natural disasters, how to an ambulance vehicle keeps contact with the nearest hospital, The most important point is that it may require sending therapeutic or logistical reinforcements to the ambulance if it is delayed for one reason or another, relying on cloud computing to accomplish this work and in cooperation with AL_Furat AL_Awsat Technical University to provide web page to be as the basic interface of the system. the future trend towards that accomplishing most of the work by remote control. The smart ambulance can be improved to be more comprehensive, and the oxygen control gate placed on the respiratory mask opens automatically when the oxygen meter reading reaches a low level and closes when it rises to the normal oxygen level.

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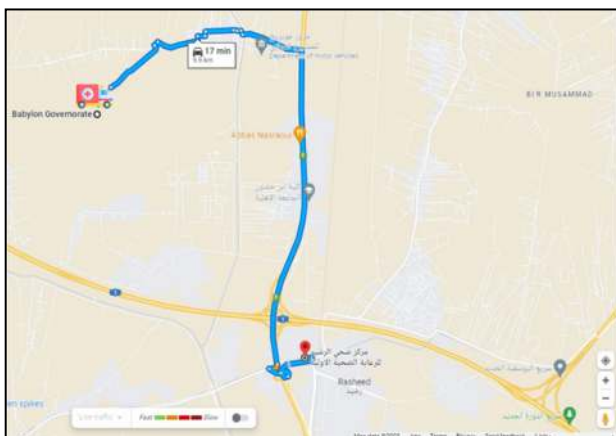
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(a)



(b)



(c)

Fig (5) (a) Login Homepage