Elderly Care System by Using ARDUINO (NODE MCU)

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Abstract

The basic idea of this paper is to design a simple patient room containing a number of sensors like : heat and humidity sensor , distance sensor and fire sensor , where all these sensors are connected to node mcu esp8266, these devices monitored the patient status by internet of things technology (IOT) , and this project aims to make the nurse control a number of rooms at the same time from her room by monitoring the computer screen that display all the immediate patient's information , and the nurses will here a warnning alarm when the patient will be at risk or make unwanted movement where he some times can not talk when the asthma attack . Also this monitoring system provides us with update medical records. Patients' data are seen and advice is given from doctors to nurse to do what needed. So the data that will be collected is sent to the server there for the nurse and doctor will enter easily to the patient's medical file and in this architecture we use a very available and not expensive equipments .This monitoring system is able to do monitoring patient's that stay in hospital for a long time , by mobile , and that enable both doctor and nurse to avoid the repeatedly unnecessary visits to the patients and go to the most risky case through the monitoring screen .

Keywords: Smart Room, Patient Room, Healthcare Systems

ARDUINO (NODE MCU) Kullanarak yasli bakim sistemi

Özet

Bu yazının temel fikri, mcu esp8266 düğümüne bağlan ısı ve nem sensörü, mesafe sensörü, ve yangın sensörü gibi birçok sensör içeren temel bir hasta odası tasarlamaktır. Bu cihazlar hastanın Nesnelerin İnterneti teknolojisi (IOT) ile durumunu izler ve bu projede tüm acil verilerin

bilgilerini gösteren bilgisayar ekranına vererek izleyen hemşirenin aynı anda birkaç oda kontrol etmesini sağlamayı hedeflemektedir ve hemşireler risk altında hastanın istenmeyen hareketler yaptığında veya astım krizi esnasında bazen konuşamadığı yerlerde alarm sesi duyacaktır. Ayrıca bu izleme sistemi bize güncel tıbbi kayıtları sağlamaktadır. Hastaların verileri görülür ve doktorlardan hemşireye gerekenleri yapmaları için tavsiyeler verilir. Böylece toplanacak veriler sunucuya gönderilir ve hemşire ve doktor hastanın tıbbi dosyasına kolayca girer. Bu mimaride yaygın ve pahalı olmayan ekipmanlar kullanılır. Bu e-sağlık sistemi, mobilden hastanın sağlık statüsünün izlenmesini olanaklı kılar ve böylece hem doktorun hem de hemşirenin hastaları tekrarlı sürelerde ziyaret etmekten ziyade izleme ekranından en riskli duruma olanlarına gidilmesine sağlanır.

Anahtar Kelimeler — Akıllı Oda, Hasta Odası, Sağlık Sistemleri

1. INTRODUCTION

Now, healthcare system is a technology that is automatically developed since there are many modern treatments and techniques, especially medical appliance and medical devices, therefore. We are looking for technologies that can offer the ability of the healthcare system to reduce human efforts , .[1]by simplifying the treatment process as well as improving the quality of life for nurses and doctors is the challenging problems.[1]

“smart” systems is made up of interacting networks between the physical and computational components. while the power and popularity of these technologies increased , researchers face the challenge of making them accessible to and useful for people with long term stay in bed.[2]

Monitoring system is one of the most necessary systems in medical field, because it can help doctor diagnose and predict a symptom before making a plan for treatment. In addition to, monitoring system can be set to an alarm that work when the patient has abnormal behavior, we can also use the e- health system in the intensive care unit (ICU) and the patient who needs special observation.. In present, the nurse continuaslly goes to check a physiological data of patient such as room temperature, oxygen saturation together with a drip and other devices. All of this is performed by enter to her cell phone or to her laptop to check the patients ,For this existing system, there are many problems

such as in case of many patients, nurses have an overload work and might yield some human error on losing the physiological data that are important for treatment[1]

This research paper has been divided into the following five sections: Section 2 describes the components which used to build the monitoring room , Section 3 describes the assemblage and installation of the components used , Section 4 describes the interface of a monitoring room , Section 5 is the result and the data that appeared by the web site sensors, section 6 is the conclusion and future work possibilities.

2. DEFINING THE DESIGN ARCHITECTURE

This room is designed for a long term patient so the medical stuff or his family could have a rest .In our design there is one patient in the room and he has **acute chronic asthma disease** , so according to the symptoms of the disease the patient should avoide (humidity , smoke and he should sit neither walk nor sleeping , so we used one node mcu esp 8266 as a wifi device and connected it to a three types of sensors that suitable with patient's case, which is :

- heat and humidity sensor
- Fire sensor
- Distance sensor

the sensor reading values updated continuously each 5 seconds . when the patient a movement out of the allowed distance, the distance sensor give a signal that alert the nurse by the warning alarm that putting in the design bellow. And this alarm will be alert if there will be a fire in the patient's room, so the patient will be at risk of abnormal breathing , because of the fire also the sensor make a signal and the (room sensor) work at the same way . After the nurse receive (see) the alarm on her computer to see what happened. And in this way the doctor also can see and monitor his/her patients easily from faraway distance by computer or smart phone . as shown in Fig.1:

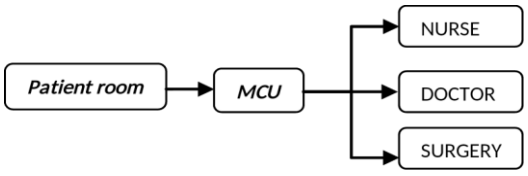


Fig. 1. Patient Room Monitoring System .

3. PATIENT'S ROOM COMPONENTS

2.1 Node MCU esp 8266

is an Arduino-compatibled board that features as the ESP8266 at its core. It becames popular because it is a Wi-Fi-ready microcontroller by itself, therefore there is - no need for an Arduino. [3] NodeMCU is an open source IoT platform.that includes firmware which runs on the ESP8266,Wi-Fi Module as shown in figure 2 from Espressif Systems,and hardware which is based on the ESP-12 module. The term "NodeMCU" refers to the firmware rather than the dev kits. NodeMCU firmware was developed so that AT commands can be replaced with Lua scripting making the life of developers more easier. and it must be redundant to use AT command again in the NodeMCU. The ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and microcontroller capability produced by Shanghai-based Chinese manufacturer, Espressif.[4]

Fig. (2) Node MCU ESP 8266 [4]

2.2 Sensors

There is many types of sensors that vary in size and function where each sensor respond to a specific type of input in the physical environment which is updated in a given period of time and simultaneously, the sampling interval is determined by the medical stuff [9], and this input maybe heat, humidity ,fire or movement in our case, but in other may be else .The output signal is converted to human-readable values which will be (numerical or charts) displayed at the sensor location or transmitted electronically over a network for reading [1] . In our monitoring system we used three types of sensors to get the required information about the patient .This sensors are:

1. heat and humidity sensor

named as (DHT 11 sensor) . put on the wall near the window to keep the weater of the room dry because humidity harm the patient, as shown in figure 3 .

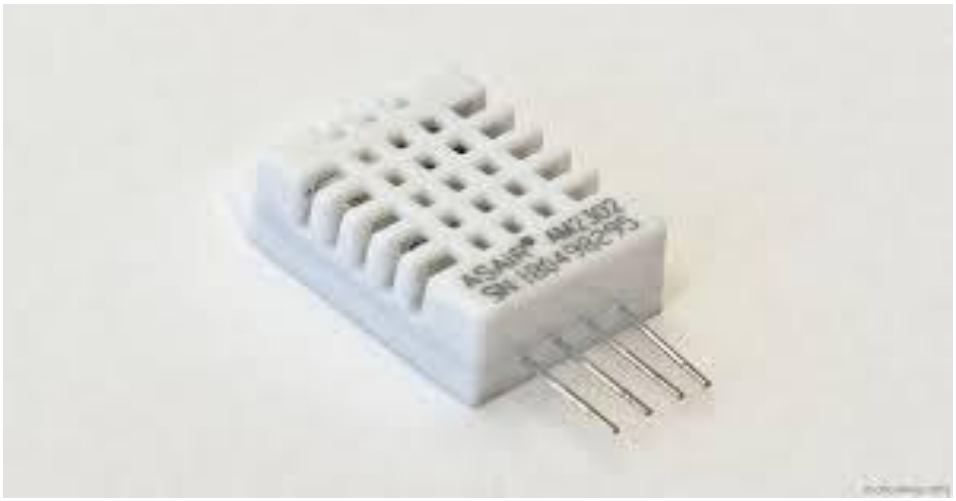


Fig.3 DHT11 heat and humidity sensor [5]

2. Fire sensor

put on the top of the room above the patient bed, we need this sensor in two cases: to protect the patient from combustion with fire and from smoke to prevent choking, the sensor obvious in figure (4) .

Fig. 4 Fire Sensor [6]

3. Distance sensor(ultrasonic sensor): Figure (5) shows the distance sensor(ultrasonic sensor) that is putted on the door to prevent the patient from unwanted movement or if the patient was in jail (in some cases),this sensor used to prevent him from escape.we should mention that this ultrasonic sensor will work as follows :

The ultrasonic sensor uses sonar to determine the distance to an object. Then

1. The transmitter (trig pin) sends a signal: a high-frequency sound.
2. When the signal finds an object, it is reflected and…
3. … the transmitter (echo pin) receives it.[7]. All these steps is shown in Figure (6)

VCC: +5VDC
Trig : Trigger (INPUT)
Echo: Echo (OUTPUT)
GND: GND

The time between the transmission and reception of the signal allows us to calculate the distance to an object. This is possible because we know the sound's velocity in the air.[8].

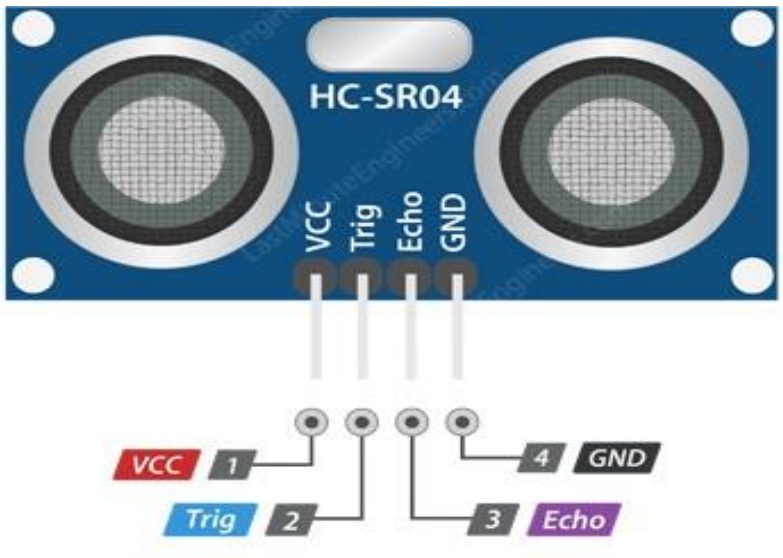
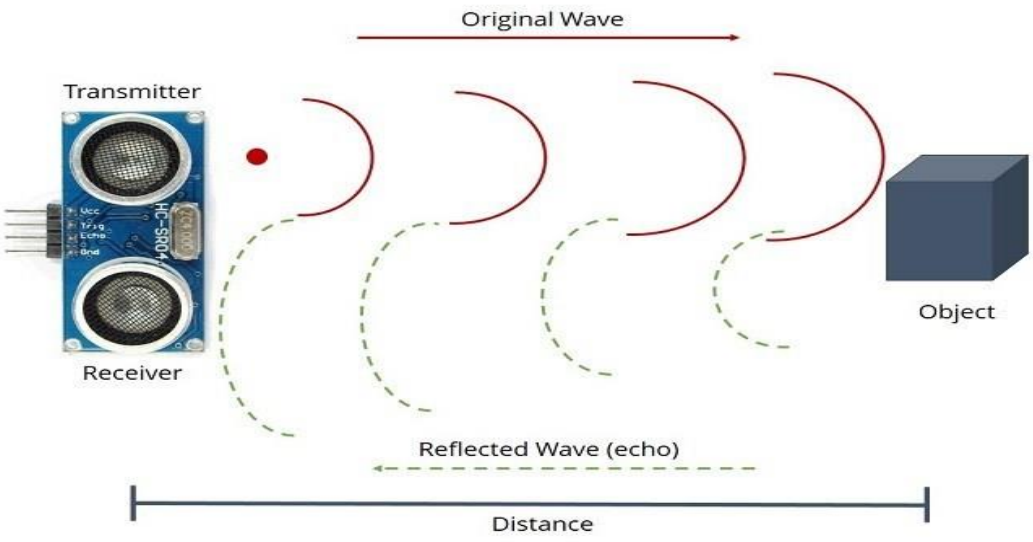


Fig.5 Distance Sensor (Ultrasonic) [7]



Fig(6) The work of Ultrasonic sensor[8]

4. ASSEMBLAGE AND INSTALLATION

First, we connect the power supply to the board with 5 V DC and since the Node MCU works with 3.3 V so we used the LLC to convert the voltages from 5 V to 3.3 volts to supply the Node MCU with the required power .

In next step, we connect the Node Mcu ESP8266 with laptop on COM 4. When Node Mcu powered we can supply power to all three sensors from it. The pins of Node Mcu connected in this form:

1. Pin 4, conncted to DHT 11 sensor .
2. pin 5 , conncted LLD as output indicator
3. Analog read pin 2 (A0) ADC receiving signal from fire sensor.
4. 5 volt pins and GND pins powered the sensors directly.
5. Pin 14 , connected to trigger pin (output) of ultrasonic sensor .
6. Pin 12 , connected to echo pin (input) of ultrasonic sensor .

   Ultrasonic sensor is consist of four general pins VCC, trig , echo, GND , The transmitter (trig pin) sends a signal [7], while (echo pin) receives the reflected signal after detect a patient body, so it can calculate the distance of the patient .

where the figure 7. shows the final form of the monitoring system . The top right (white) sensor measure the temperature that is showing in with two measure units Celsius and Fahrenheit, showing in the first bar in figure 8 . The same sensor also measure the humidity which is appear

in the second progress bar in the results in the same figure , the fire signal sensor that appeared in the left bottom of the final form at figure 8 . when the sensor noticed a fire in the room which work on two states either zero if there is no fire or one(100%) , if there is a fire .

The distance sensor (ultrasonic), in the middle side, showing distance signal if there is a motion.Fig . showing distance sensor detection in two state first empty which mean no movement detected.And the second orange which mean the patient movement detected.

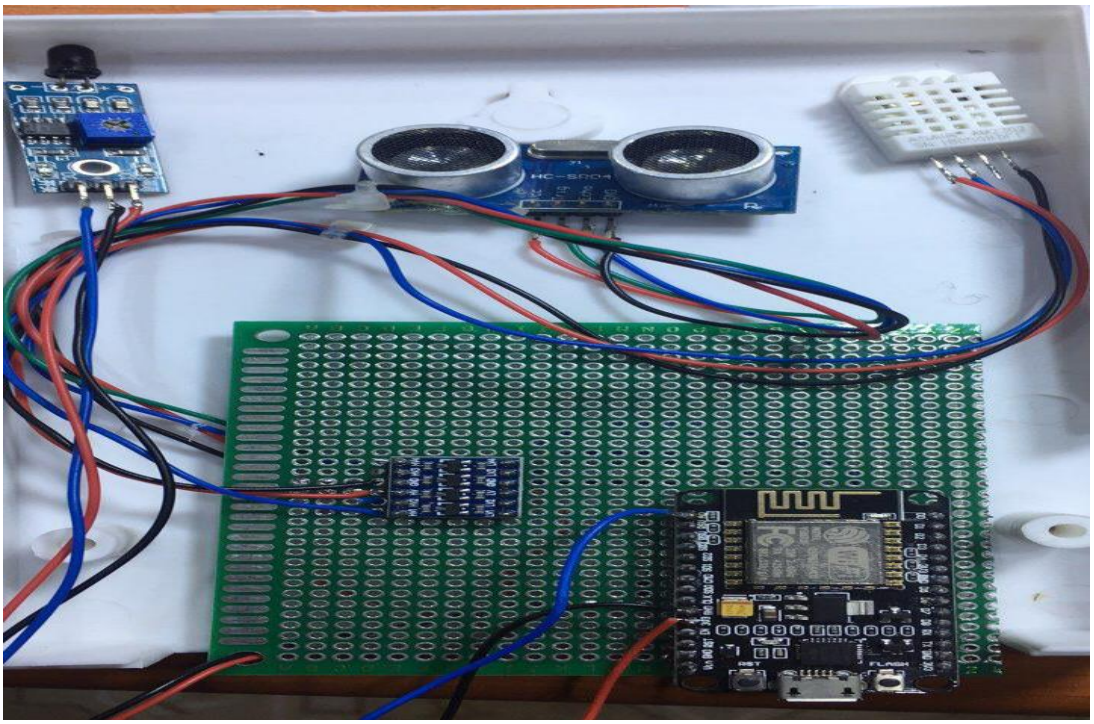


Fig.7 final form of the monitoring system

5. PROGRAMING LANGUAGES USED

We use two programming language in this project which is HTML and C Language ,HTML for designing a web page with four progress bar that shows the sensor values . While , C Language for programming the interface between the physical components :

5.1 HTML : HTML stands for Hyper Text Markup Language, which is the most widely used language on Web to develop web pages. HTML was created by Berners-Lee in late 1991 but "HTML 2.0" was the first standard HTML specification which was published in 1995. HTML 4.01 was a major version of HTML and it was published in late 1999.

Though HTML 4.01 version is widely used but currently we are having HTML-5 version which is an extension to HTML 4.01, and this version was published in 2012.[9]

5.2 C : C is a general-purpose, high-level language that was originally developed by Dennis M. Ritchie to develop the UNIX operating system at Bell Labs. C was originally first implemented on the DEC PDP-11 computer in 1972. In 1978, Brian Kernighan and Dennis Ritchie produced the first publicly available description of C. C has now become a widely used professional language for various reasons: Easy to learn, Structured language , It produces efficient programs , It can handle low-level activities. Today C is the most widely used and popular System Programming Language. Why Use C? C was initially used for system development work, particularly the programs that make-up the operating system. C was adopted as a system development language because it produces code that runs nearly as fast as the code written in assembly language .[10]

6. RESULTS

Table 1 showing the data which collected from three sensors ,where we obtain 4 values because the heat an humidity sensor sense two values as shown in the figure 8 .

TABLE I. RESULT

Sensors				Detection
Heat	Humidity	Fire	Distance	
23%	37%	0	1%	No fire
30%	77%	55%	7%	fire
24%	34%	100%	5%	fire

Our results appeared on the browser window. And this window shows the status of the four sensors as four progress bar on the web server . There are four values for each time in the window as shown in the following figure.

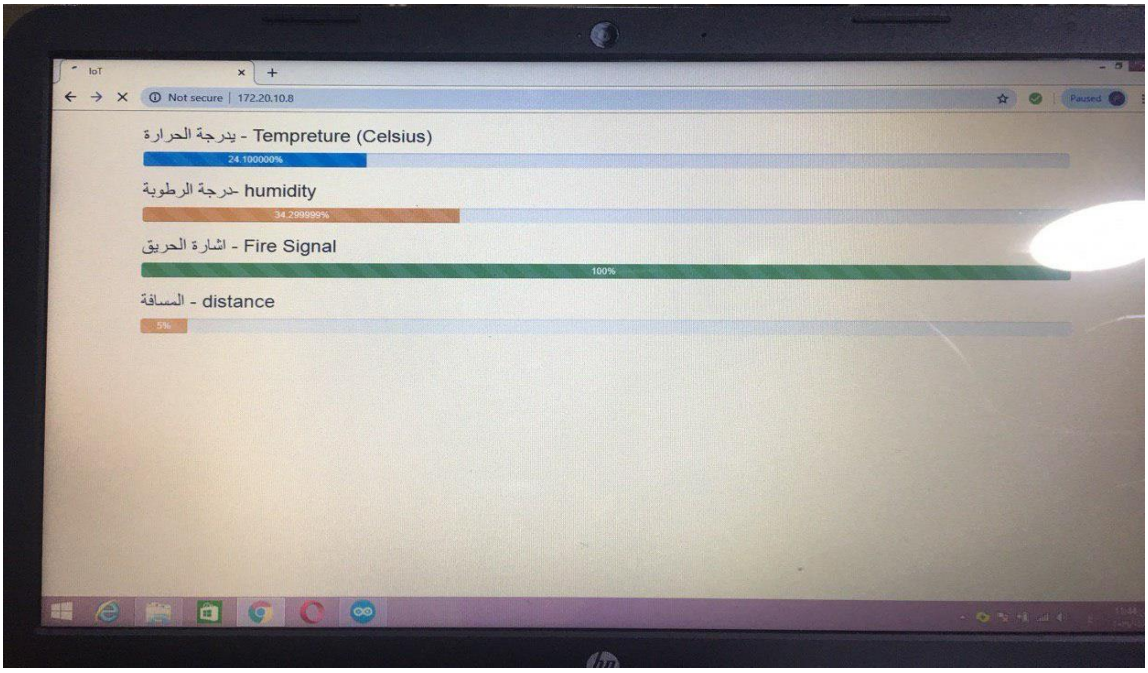


Fig.8 Sensor values

7. CONCLUSION AND FUTURE WORK

In this paper we proposed a monitoring system, [1-2] which is able to continuously monitor the patient's room , especially the arrounding critical parameters in the hospital. our system consists of a number of sensors that acquire the patient's required data, in this system the data is collected and forwarded to the server . This system is completely efficient to carry out a monitoring on patient's case . the patient issue becomes a very serious social problem , therefore , this monitoring room system will be solved by internet of things technology . we must know that patient monitoring room by nodemcu and number of wireless sensors and alarm has a lot of application in reality. And in Emergency healthcare has also been identified as a possibility by medical stuff, but has not yet been widely researched.

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