Journal of Robotics and Control (JRC)
Volume 2, Issue 5, September 2021
ISSN: 2715-5072 DOI: 10.18196/jrc.25111

Automatic Wireless Nurse Caller

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***Abstract*—The nurse caller device is used as a special communication device between the patient and the nurse within the hospital area as a means of speeding the nurse's time response in providing immediate care to the patient. The designed wireless-based nurse caller device made installation easier and neater. The remote used a Bluetooth module MH-10 connected to the ATMega8 microcontroller as the sender and receiver. The data process using a microcontroller ATMega8 produced characters on the LCD, turned on the LED, and activated the buzzer to call the nurse. The results of the test on the device showed that the farthest distance taken by the HM-10 Bluetooth module in the open area (outdoor) was about 45 meters, and the closed area (indoor) was about 20 meters.**

Keywords—hospital, nurse caller, microcontroller

I. INTRODUCTION

The hospital is an integral part of a social and health organization with the function of providing plenary (comprehensive), healing (curative) and disease prevention (preventive) services to the community whose services are handled by doctors, nurses, and other health experts. Nurses are considered as the spearhead in the organization of hospital services because it is the nurse who continually provides care to patients.

The nurse continues to monitor health and provide care to the patient. Several previous studies have conducted research on nurse callers. The techno-economic evaluation of an ontology-based nurse call system through discrete event simulations was investigated by Vannieuwenborg [1]. The design development and implementation of the Wired Nurse call system was researched by Sharma [2]. A study on the automatic evaluation method of designating and invoking nurse education was researched by Maekawa [3]. The development of smart house call system and android based nurse for different abilities was researched by Khera [4]. A real-time feedback-centric nurse call system with archival monitoring using a Raspberry Pi was investigated by Mahmud [5].

The hospital is equipped with a calling device in each patient's bed/room to speed up patient services. Currently, the nurse calling device used is very conventional, namely, it still uses a pair of cables. Electronic technology innovation is one of the ways for patients and nurses to interact more quickly. A component that can calculate, remember, and make choices using a microcontroller is needed to make this device. The microcontroller is a chip or an IC that contains a processor and a flash memory capable of reading and writing up to 1000 times. The cost of development is inexpensive because it can be minimized and refilled with other programs as needed.

Wireless network technology has been widely researched by previous researchers. The WIFI-Microcontroller-based Capacitive Water Wireless Sensor System Model was investigated by Suryono [6]. Smart Irrigation Based on Arduino Using WiFi Sensor and Module ESP8266 researched by Thakare [7]. Obtaining Information about Neighbor Street Lights Using the WIFI Mesh Network was researched by S.N [8]. WiFi Activated Speech Recognition Control Nodes were investigated by Riviezzo [9]. Xiao [10] investigated the design of household appliance control systems for Smart Home based on WiFi IoT. An efficient remote control system using SMS and WiFi technology for outdoor security lighting applications was investigated by Akorede [11]. A smart car design based on WiFi video capture and OpenCV motion control was investigated by Dai [12]. A 220 volt power switch controlled via WiFi was investigated by Gao [13]. Robotic Vacuum Cleaner Using Arduino with Wifi was researched by Jarande [14]. Internet-based monitoring and protection of the smart PV grid system was investigated by Pramono [15].

CampusSense - Smart Vehicle Parking Monitoring and Management System using ANPR Cameras and Android Phones researched by Aalsalem [16]. Intelligent Environmental Monitoring through the Internet of Things (IoT) using RaspberryPi 3 was researched by Sriyanka [17]. Occupancy estimation based on environmental sensors in buildings through IHMM-MLR was studied by Chen [18]. Real time carbon dioxide emission system based on participatory sensing technology researched by Yu [19]. Comprehensive Monitoring and Analysis Instrument Design for Mine Environment was researched by Tian-He [20]. IOT-based Smart Community Monitoring Platform for Smart Homes that work Specifically was researched by Nettikadan [21]. The equipment control and environmental environment of the smart home were researched by Shiqi [22]. Automated Service Request System for Security in Smart Homes Using IoT was researched by Madupu [23]. Edge-Based Smart

Parking Solution Using Camera Networks and Deep Learning was researched by Bura [24]. The Monitoring and Ventilation Control System for Multi-storey Historic Buildings was investigated by Singh [25].

Nurse calling devices can facilitate communication between patients and nurses in the hospital area when patients need help in a case of emergency. This nurse calling device is different from the nurse caller that has been researched by previous researchers. This nurse caller uses wireless technology. So that the installation does not require a lot of cables.

II. METHOD

The components of the device are arranged in a system as illustrated in Figure 1.First, when the call button is pressed, the microcontroller receives input from the button call sensor data which is then processed by the microcontroller to be transmitted using the HM-10 Bluetooth module to send a signal, and the signal is received by the receiver. The HM-10 Bluetooth module is then processed by the microcontroller client to be displayed on the LCD in the form of a patient call, LED and buzzer lights up. Second, when the stop button is pressed, the microcontroller receives input from the button stop sensor data then it is processed by the microcontroller to be emitted using the HM-10 Bluetooth module to send a signal, and the signal is received by the HM-10 Bluetooth module receiver then processed by the microcontroller client to be displayed on LCD in the form of stop call, LED and buzzer off. [26], [27]. ATMega8 microcontroller is used to process input data from the sensor button and then transmitted to the blootooth transmitter.

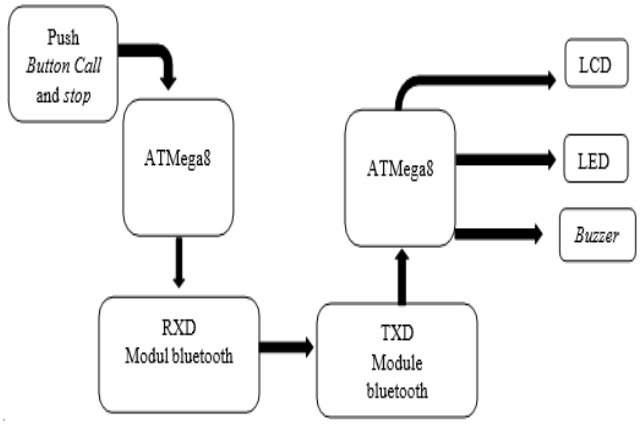

Fig. 1. System components

Further, the LCD displayed the characters and numbers. The LED as an indicator and the buzzer as an alarm was then active/ON. When the stop button was pressed, the HM-10 Bluetooth transmitter [28] sent a signal, and it was received by the HM-10 Bluetooth receiver [29]. The characters or numbers on the LCD was deleted, and the LED indicator and buzzer alarm turned off. The system work flow was shown in figure 2.

A. System work flow

The flowchart of automatic wireless nurse call is shown in Figure 2. From this figure, it can be seen that the program starts with register initialization, displays the display and waits for the call and stop button presses. When the call button is pressed, data is sent and received for an active call. When the stop button is pressed, data is sent and received for delete call. When the call is active, the LED lights up and when the call is not active the LED turns off.

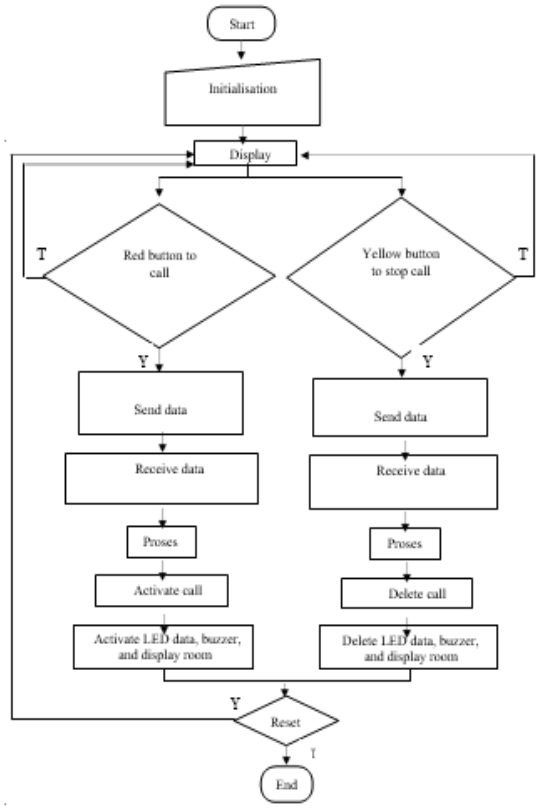

Fig. 2. System work flow chart

The visualization of the transmitter device is shown in Figure 3. From this figure, it can be seen that there are 4 buttons to call the nurse and 4 buttons to stop calling the nurse. The nurse calling device uses a 220 Volt AC voltage and uses a current safety.

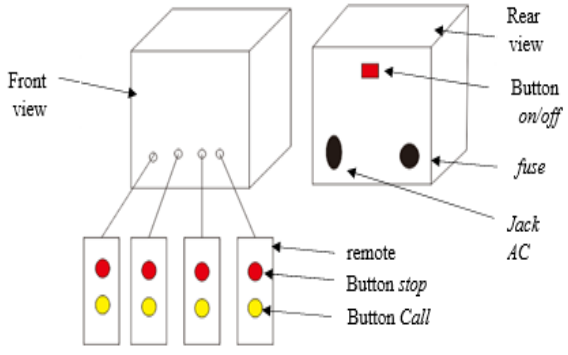

Fig. 3. Transmitter device visualization

The visualization of the receiving device is shown in Figure 4. From this figure, it can be seen that there are 4 indicator leds for each patient bed. When the patient in the bed first presses the nurse call button, the LED indicator for the first patient bed lights up. In addition to the LED indicator, there is a display in the form of an LCD to display

patient status. The nurse calling device uses a 220 Volt AC voltage and uses a current safety.

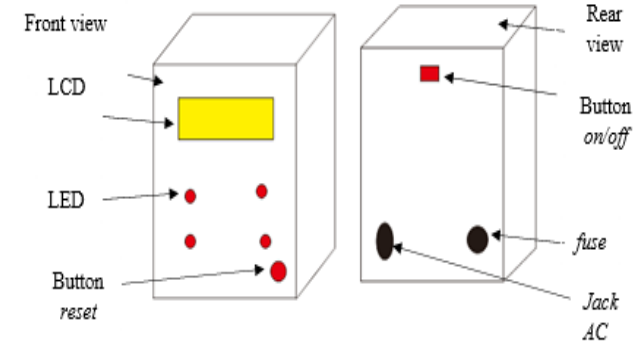

Fig. 4. Receiver device visualization

B. Power supply

The design of the power supply circuit used Proteus application in the computer to create the module. The power supply circuit in this module served as a voltage supply to all circuits that used direct current (DC) voltage. The working principle of power supply was to change the alternating current (AC) voltage to a DC voltage by using a transformer as a voltage reducer and a diode as a voltage rectifier. In this module, the power supply changed the AC to DC by using a regulator IC 7805. The 5 VDC voltage produced was used to supply the minimum system.

C. Minimum system

The minimum system circuit design uses applications on laptops, the application used in making this module is proteus. Here is a schematic drawing of a minimum system circuit.

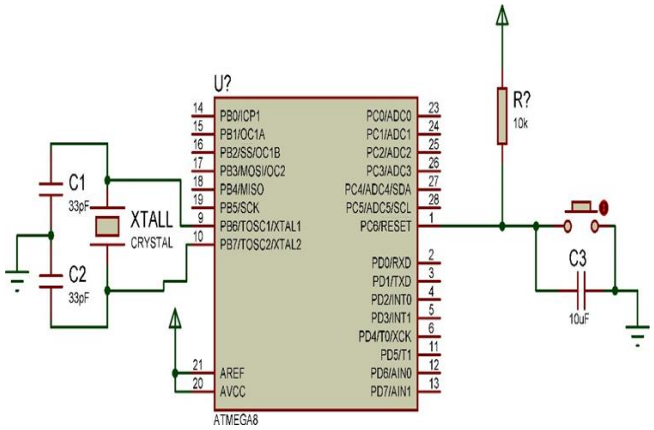

Fig. 5. Minimum system schematic

The minimum system circuit in this module functions as the overall module work controller. The workings of the minimum circuit system utilize the storage capacity of ATMega8 IC. In this ATMega8 IC is given a program that will control the module work system as a whole. The application program used in this module is CVAvr.

D. Overall hardware design

The schematic of a nurse calling device transmitter is shown in Figure 6. From this figure, it can be seen that the LCD display is connected to Port C on the microcontroller. For the receiving module connected with Pin TX, RX. The led indicator is connected to Port D.

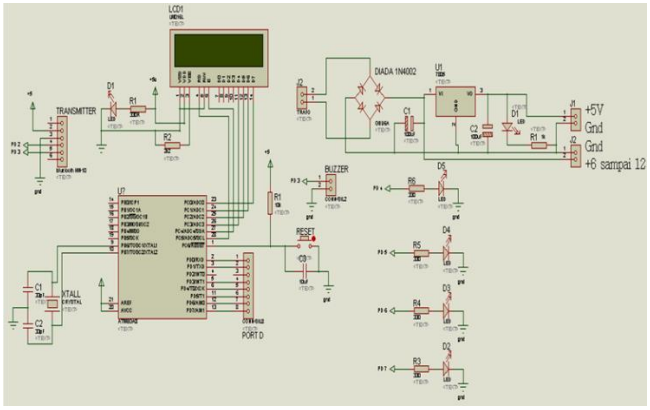

Fig. 6. Transmitter device schematic

The schematic circuit of the receiving device is shown in Figure 7. The nurse call button and the call stop button are connected to pin C on the microcontroller. Meanwhile, the transmitter module is connected to pin D of the microcontroller.

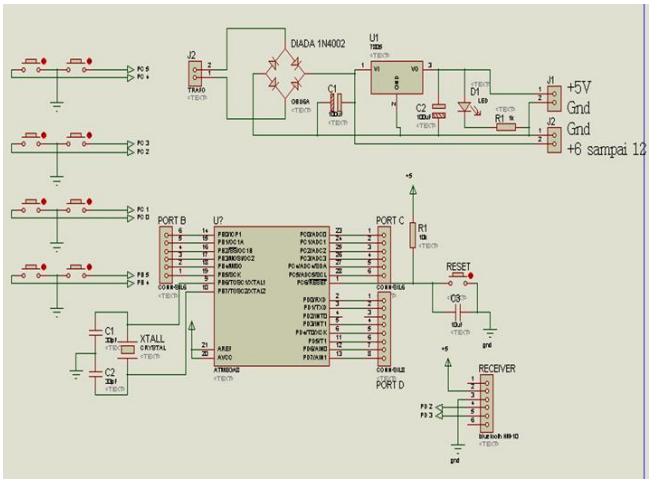

Fig. 7. Receiver device schematic

E. System testing

In the analysis of the test design there are 2 parameters to be tested namely:

1) Indoor testing. Testing device on the horizontal and vertical distance in the room to know the distance that can be traveled by the wireless module in the room.

2) Testing outdoors. Testing device on the horizontal and vertical distance outside the room to know the distance that can be traveled by the wireless module outside the room.

F. Research variables

The variables used in the study are dependent variables, namely LED, push button, buzzer and LCD. As a controlled variable, the Atmega8 microcontroller IC and HM-10 bluetooth module.

III. RESULT AND DISCUSSION

Engineering wireless device to call nurses using one receiver and one transmitter with an HM-10 Bluetooth

module. On the transmitter there are four remotes that are connected with a call button and stop button, so that one remote can be placed in each room / bed.

Fig. 8. Overall device visualisation

A. Transmitter

When the switch is pressed, the voltage from the grid of the state electricity company (PLN) will enter the power supply to change the voltage to DC. The minimum system circuit gets a 5 volt DC voltage supply that enters the HM-10 bluetooth module which will be processed for removal at the specified port. In this device port D0 and port D1 are set as the output of the maximum system circuit that will be connected to the HM-10 bluetooth module.

The outputs from port D0 and port D1 are used to activate the HM-10 bluetooth module which functions as a wireless data sender. Whereas on ports B4, B5, C0, C1, C2, C3, C4, and C5 are set to activate buttons that function as call and stop buttons.

B. Receiver

When the switch is pressed, the voltage from the grid will enter the power supply to change the voltage to DC. The minimum system circuit gets a 5 volt DC voltage supply that enters the HM-10 Bluetooth module which will be processed for removal at the specified port. In this device port D0 and port D1 are set as the output of the maximum system circuit that will be connected to the HM-10 bluetooth module.

The outputs from port D0 and port D1 are used to activate the HM-10 bluetooth module which functions as a receiver of data sent by the sending module. On ports C0, C1, C2, C3, C4, and C5 are set to activate the LCD which functions as a room / bed number viewer that makes calls and stops calls.

On port C6 is set as the output of the reset button which functions to repeat or restart the program from scratch. On port D3 is set as the output of the buzzer in the form of an alarm when the call button is pressed. While on ports D4, D5, D6, and D7 are set to activate LEDs that function as a room / bed number viewer that makes calls, as well as LCDs but the difference is the appearance, because the LEDs only expose light and the LCD displays character letters / numbers.

C. System test

In the test will be carried out several stages with distance and barrier variables. In testing with distance variables an experiment will be carried out sending data packets from certain distances and certain time intervals. In testing with a variable barrier, a packet data will be sent with the condition of an object such as a wall blocked.

Horizontal outdoor test results show that this equipment is functioning properly when the distance between the transmitter and receiver is less than 45 meters. while indoors is less than 15 meters.

The results of outdoor testing vertically indicate that this equipment is functioning properly at a distance between the transmitter and receiver is less than 15 meters. while indoors is less than 3 meters.

IV. CONCLUSION

After making the process of making, experimenting, testing device and data collection, the author can conclude that making a nurse call device using a Bluetooth module can simplify installation and will look neat. To make these device needed a component that can calculate, remember, and take choices using a microcontroller. Displaying the commands found on the LCD and LED will make it easier for nurses to get information on the patient's room that is calling. Based on the results of taking data on measurements outside the room horizontally and vertically prove that the wind can affect the frequency of the bluetooth module so that the distance measurements get different results. In the horizontal data retrieval obtained a distance of 45 meters and a vertical distance obtained 15. Based on the results of taking data on measurements in the room horizontally and vertically prove that the thickness of the wall can affect the frequency of the bluetooth module so that the distance measurements get different results. In the horizontal data retrieval obtained a distance of 20 meters and vertical obtained a distance of 5 meters.

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