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PROTECTION SYSTEM FOR MEDICAL WORKERS FROM (COVID-19) PATIENTS USING ARDUINO (ATMEGA328P)

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Abstract-The spread of COVID-19 virus commencing in Wuhan, China in December 2019, the coronavirus has reached to a minimum of 183 countries. During this pandemic situation the medical workers are additional exposed to the virus relatively the normal people, therefore we have developed a wireless monitoring system to take care of the protection between medical workers and COVID-19 patients. The primary plan of this system is to design and implement an entire wireless nurse call system within the hospital, showing the patient room and bed number on a display. Our proposed system implements an Arduino UNO microcontroller and several wireless devices using RF technology used to monitor and display the condition of any room / patient / medical facilitate or assistance required, in order to provide fast and respectable medical service without any human errors or medical help delay. In case of emergency the CODE BLUE alert provides 24/7 service.

Keywords-Wireless nurse call system, nRF24L01, Arduino UNO board, COVID-19, Code blue alert.

I. INTRODUCTION

COVID-19 virus transmission the corona virus, which first appeared in Wuhan, China in December 2019, has spread to at least 183 countries. During a pandemic, medical staff are exposed to the virus at a higher rate than the general public; the risk of infection-related mortality is 17 times higher in doctors and 15 times higher in healthcare workers. According to the IMA (Indian Medical Association), the incidence of death from Covid-19 infection is 17 times higher in doctors and 15 times higher in healthcare staff than in the general population. In India, there are 4,969 cases of infected healthcare staff, 1,428 cases of infected physicians, and 285 cases of others per lakh residents. In every one lakh Covid-19 patients, doctor deaths are 87, healthcare personnel 16 and common people five. According to the IMA, the positivity rate among healthcare workers was 4.6 percent from January to May. It was also discovered that 2.8 percent of healthcare staff came into touch with reported cases of Covid-19 without sufficient protection. These preliminary estimates are now showing why it has spread so quickly among healthcare employees. They have paid the price for not treating the infection seriously and choosing to work in the health sector. More than 87,000 healthcare staff have been infected with Covid-19, with only six states responsible for three-quarters (around 74 percent) of the case burden and over 86 percent of the 573 deaths due to the infection, according to official statistics. According to the report, Maharashtra alone accounts for about 28 percent of the infected healthcare workers and more than half of the total deaths, with over 7.3 lakh confirmed Covid-19 cases so far. Though Maharashtra, Karnataka, and Tamil Nadu each screened over 1 lakh healthcare workers by August 28, Karnataka registered only 12,260 infected healthcare workers, nearly half of Maharashtra's total. Doctors and nurses were among the 11,169 cases recorded in Tamil Nadu. Together, the three states accounted for 55% of all cases among health employees. The three states also had the highest number of deaths among healthcare employees, while Maharashtra was well ahead of the other two. Maharashtra had 292 deaths among healthcare staff, while Karnataka and Tamil Nadu each had 46 and 49 deaths.

Doctors are vulnerable to high viral loads because they see patients on a regular basis and the time between two patients is limited. Many doctors have been exposed as a result of infrastructure concerns in small and medium-sized hospitals. When healthcare staff become infected as a result of a high viral load, their health rapidly deteriorates. Healthcare staff are on the front lines of the global campaign to treat COVID-19 patients, putting

themselves at risk of infection in the process. Thousands of people have already died, representing hundreds of cultures, trades, and specialties. All of them are honoured here. Physicians, nurses, managers, technicians, orderlies, supervisors, volunteers, drivers, porters, EMTs, firefighters, and more are all honoured here, whether they are new to the job or retired. Doctors' lives must be saved. Who will save the patients if the doctors start dying.

II. RELATED WORK

The need for an efficient nurse call system arose when patients started to get moved into more private rooms instead of sharing a common space; this move limited the visual awareness nurses had of their patients, and thus created the need for other ways to perceive their patient's needs (Solumsmo and Aslaksen 2009) [1]. Remote control or local control is always useful for those human being who are physically challenged in the world. Such a system always aids them for spending life more easily then without such systems [2]. the key of nurse calling system is to make calls from patients to remotely situated nurse control room [3].

Ordinary nurse call systems aren't up to the challenge of supplying patients, residents, and their families with healthy and comfortable technology. [4] A wired system may have up to 24 wires per room, resulting in spaghetti wiring and increasing installation difficulties, as well as scheduled and unscheduled maintenance. Additionally, these traditional systems are incapable of storing data regarding both patient and nurse behaviours, resulting in human resource allocation with no data backup.[5] Installing a nurse call system can be cumbersome, time-consuming, and costly. With wireless nurse call systems, however, this will no longer be a problem [6].

III. METHODOLOGY

The main objective of the proposed system to protect the medical workers from the patients.

A. Problems identified in existing method

- The above projects observed that the main problem is the clarity in nurse call i.e. the normal patient call & critical patient call.
- The above surveys do not identify the type of call.
- In some cases, normal call make in wireless unit and critical call could be used with wire.
- The systems are used in two separate locations to identify the type of call.
- No information about the loss of connectivity has been given.

A Patient need any medical assistance they push a button switch, then the signal could be processed by

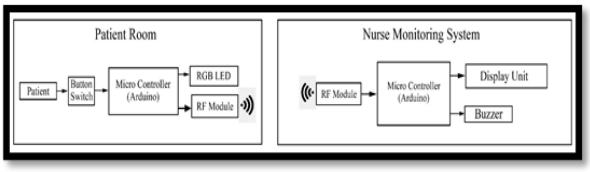

Fig 3.1: Block diagram of Normal Patient Call

The Arduino and RF module are usually set to TX (transmitter) mode, modulating and transmitting the signal to the nurse monitoring device, which demodulates and processes the signal via Arduino, displaying the patient Room and Bed number in the display unit and emitting a buzzing sound from the

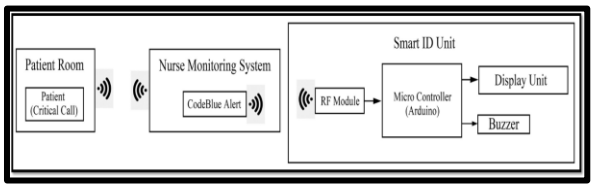

Fig 3.2: Block diagram of Critical Patient Call

buzzer. When a signal is received from a patient room, the nurse monitoring device enters RX (receiver) mode and ACKs (acknowledges) the patient unit, which emits a green light via RGB LED. The patient receives the signal based on the LED indication. As seen in the example above, it was a success. Figure 1.

In the event of an emergency, the nurse control system sends a CODE BLUE ALERT to the SMART ID UNIT, which is carried by the duty doctors. The unit shows the patient's room and bed number on the board and sounds a buzzer. The nurse system also indicates the CODE BLUE ALERT in the room as shown in above Figure 2. Communication Between Patient Room unit and Nurse Monitoring System as same as the Normal Patient Call Operation.

IV. PROPOSED SYSTEM

Our proposed framework is designed to solve all of these flaws in a practical manner, ensuring high quality and dependability for life protection. The basic idea is to create and incorporate a full wireless nurse call system in the hospital that uses RF technology to continuously

monitor and display the condition of any room, patient, medical help, or assistance that is needed, in order to provide quick and respectable medical care with no medical assistance wait.

This proposed system could be divided into three major modules are:

1. Patient Room Unit
2. Nurse Monitoring System
3. Smart Id Unit

Arduino UNO is a basic and inexpensive Arduino board and is the most popular of all the Arduino boards with a market share of over 50%. Arduino UNO is considered to be the best prototyping board for beginners in electronics and coding. UNO is based on ATmega328P microcontroller. There are two variants of the Arduino UNO: one which consists of through – hole microcontroller connection and other with surface mount type. The through-hole model would be advantageous because it will be possible to remove the chip in the event of a malfunction and replace it with a new one.The Arduino UNO has a variety of features and capabilities. As previously mentioned, the ATmega328P microcontroller used in UNO is an 8-bit microcontroller based on the AVR architecture. The 14-digital input/output (I/O) pins on the UNO can be used as either input or output by attaching them to various external devices and components. Out of these 14 pins, 6 pins are capable of producing PWM signal. All the digital pins operate at 5V and can output a current of 20mA.

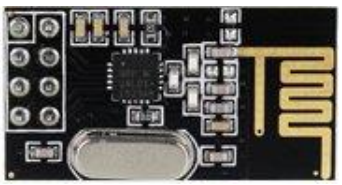

Fig 4.1: nRF24L01+ Wireless Module

The nRF24L01+ transceiver module operates in the 2.4 GHz worldwide ISM frequency band and transmits data using GFSK modulation. A data transfer rate of 250kbps, 1Mbps, or 2Mbps is possible. The 2.4 GHz band is one of the Industrial, Scientific, and Medical (ISM) bands designated by the International Standards Organization (ISO) for the use of unlicensed low-power devices. Cordless phones, Bluetooth devices, near field communication (NFC) devices, and wireless computer networks all use ISM frequencies (Wi-Fi).The module's operating voltage ranges from 1.9 to 3.6V, but the good news is that the logic pins are 5-volt tolerant, so we can link it to an Arduino or any other 5V logic microcontroller without the need for a logic level converter, as shown in Figure 4.

A liquid crystal display (LCD) is an electronic display module that uses liquid crystal to produce a visible image. On a 16*2 matrix LCD, the status of the horn count, the load on the measures, and the amount of smoke generated by the vehicle are all displayed. As a result, only 32 characters can be viewed using this display.

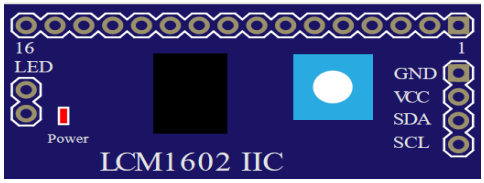

Fig 4.2: LCM1602 I2C

I2C (Inter Integrated Circuit) was created by Philips in 1982 for use in a variety of Philips chips. SPI (Serial Peripheral Interface) and UARTs (Universal Asynchronous Receiver/Transmitter) combine their best features in I2C. Multiple slaves can be connected to a single master (like SPI) with I2C, and multiple masters can manage single or multiple slaves. This is really useful when you want to have more than one microcontroller logging data to a single memory card or displaying text to a single LCD.

SDA (Serial Data) – The data transmission and reception line between the master and slave.
Serial Clock Line (SCL) – This is the line that holds the clock signal.I2C communication, like UART communication, uses only two wires to send data between devices, as shown in Figure 4.

V. EXPERIMENTAL RESULTS

When a patient requires medical assistance, they press a Button Switch, which sends data to the RF Module, as shown in Figure 5a below

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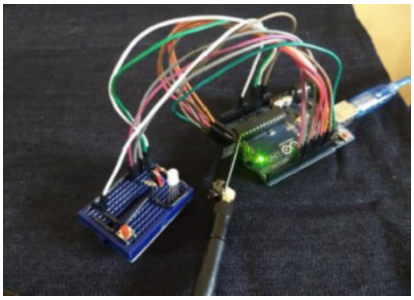
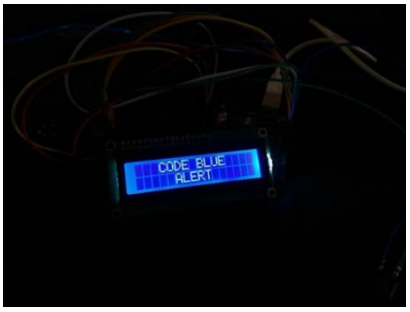


Fig 5.1: Patient Room Unit

Fig 5.2: Nurse Room Unit

As shown in Figure 5b, the Nurse Room Unit receives a signal from the Patient Room Unit and shows the patient room and bed number.In case of emergency nurse room unit sends the CODE BLUE ALERT to Smart ID Unit contain by the duty doctor. It displays Patient room and bed number in the display unit as shown in below Figures 6(a)(b).

(A)



(B)

Fig 6(a) and 6(b): Smart ID Unit Received Signal from Nurse room Unit

VI. CONCLUSION

Our intended system utilizes wireless technology because there is no need to install cables to any of the call points, and the impact is minimal. Wireless systems are also less expensive to instal and operate than conventional hard-wired systems, as well as being faster and easier to set up. Our system's wireless configuration provides maximum versatility and agility, making it indefinitely adaptable changeable and expandable, thus allowing for the constant ability to deal with ever changing priorities and demands. Our system is also safe, dependable, and cost-effective. It can be customised to meet specific specifications and needs, as well as tailored to suit any hospital budget. It also has a number of features that can help increase staff productivity and the overall quality of care provided to clients and patients in the health-care industry.

REFERENCES

[1] Antoni Morey, Pasqual," Composition of New Features into Wireless Nurse Call System" Master of Science in Communication Technology, Norwegian University of Science and Technology, Jan 2011.

[2] L. McGillis Hall, C. Pedersen, and L. Fairley, "Losing the moment: Understanding interruptions to nurse's work", JONA, 40(4), pp. 169-176,2010

[3] Tika Miller, "Nurse Call Systems: Impact on Nursing Performance," Journal of Nursing Care Quality, Vol.11, Issue 3, Feb. 1997, pp. 36-43.

[4] "ATMEL Wireless Production Test Reference"; 42253A–WIRELESS–03/2014, issued in 2014.

[5] "NPpocket Nursing" Book, 1st edition, issued in 2017; ISBN-13: 978-1943991693

[6] .Mohamed Hesham Aref1, Ahmad Aly El-Shinnawi2 , Amr A. Sharawi3 "Wireless Nurse Call System in Medical Institutions" American Journal of Biomedical Research, Vol. 6, No. 2, 40-45,2018.

[7] Ravi Pratap Singh , Mohd Javaid , Abid Haleem , Rajiv Suman "Internet Of Things (Iot) Applications To Fight Against COVID-19 Pandemic "Diabetes & Metabolic Syndrome: Clinical Research & Reviews 14 (2020) 521e524, April 2020.

[8] Brody Heritage, Clare Harvey, Janie Brown, Desley Hegney, Eileen Willis,Adele Baldwin, David Heard, Sandy Mclellan, Virginia Clayton, Jamin

Claes,Melanie Lang2, Venessa Curnow" *The Use Of Telephone Communication Between Nurse Navigators And Their Patients*" Heritage B, Harvey C, Brown J, Hegney D,Willis E, Baldwin A, PLoS ONE 15(1):e0227925 et al,Jan 2020.

[9] F M S Nursuwars and A Rahmatulloh "RFID for nurse activity monitoring in the hospital's nurse call system with Internet of Thing (IoT) concept "IOP Conf. Ser.: Mater. Sci. Eng. 550 012025, 2019.