NURSE CALLING SYSTEM IN HOSPITALS FOR EMERGENCIES USING ARDUINO AND BLUETOOTH MODULE

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ABSTRACT

Any medical facility, ICU, or hospital should have a nurse call systems because they have an indirect impact on the patient's life. The recent pandemic taught me how there can be such a huge load on medical doctors and how much chaos it created when there is such a disaster and the hospitals are just filling up patients and patients. At the same time, we have seen the development in touch screen technology over the years. How it has evolved and how it has spread in all sectors extensively. The use of touch screens and their different characteristics is applied everywhere, from small to big and important areas. That's where we can also use the same in the medical field for different purposes, here we have used it in the Nurse Calling System to alert the staff in the hospital when there is an emergency in a certain ward. This paper's main goal is to build and construct a complete wireless nurse call system for the hospital that shows the patient's room number on a desktop LCD. We have built the Nurse Calling System using Arduino Uno, Node MCU, Bluetooth model, and other things.
In accordance with IEEE Standard 1621, this work describes the design/construction, development, and numerous technologies underlying touch screens that make Nurse Calling Systems.

Keyword: - Nurse calling system, Touch Screen Hospital, emergency, medical call. Arduino- Uno. NodeMCU.

1. INTRODUCTION

Now a days instead of mouse most of the people prefer touch screen to interact directly with what is presented. (Except with a stylus, which is typically not required on more recent touchscreens). The use of electronic voting devices, point-of-sale, tablet computers, smartphones, and mobile gadgets all utilize touchscreen technology. We are talking so much about the touch screen because it's the most important term we use when building the Nurse Calling System. The touch screen module is the most important component when doing the Nurse Calling System A wireless nurse call system is a new innovation in technology that is built on the most advanced wireless technologies. This enables individuals to use them in a straightforward and comfortable manner while quickly receiving medical attention. That is whenever there will be an emergency case and the doctor/staff isn't nearby then we can use such a Nurse Calling system to generate an alert so that the patient can be handled as quickly as possible and the doctor will get to know about such cases and where exactly he is needed. Also, such a Nurse Calling System, we can use for specially disabled people who face trouble in completing their daily chores and at such times they can call for help from a Nurse. Thus, such systems are very useful in hospitals and other medical centers. Also, the major use of this can be done when there are more patients than the doctors/nurses and staff and all are in need of treatments. So, this can be used when there is an utter emergency of a patient who is unattended and is in immediate case of treatments.

It's very easy for hospital staff to deploy and operate within minutes because it doesn't require the use of any cables, unlike older nurse call systems. Systems for wireless nurse calls can handle a large number of beds. No further

upkeep is required because the medical assistant may directly influence the hospital patients' health. Since the Federal Food, Drug, and Cosmetic Act (FDA) rules and other medical standard codes like the European Standard (ISO 7369) and the American Standard have made quality and reliability so crucial to patient and life safety, this has become so crucial (NFPA 99). Also, the recent pandemic taught us how it is important for such technologies to develop in the field of Medics, paramedics, and bio medics, and how it is important for proper coordination and cooperation between staff and doctors in hospitals when they have a huge load and patients.

2. Literature Review

In 1965, E.A. Johnson created the first capacitive touch screen in Malven, England. In 1967, the very first article was released. In 1968, the air traffic control article was published. And thus the right and proper development of the Touch Screen started and it began to interest many researchers and many techno-enthusiasts. Then, engineers from CERN (European Organization for Nuclear Research) developed a transparent touchscreen at the start of the 1970s. This was created by two engineers, Frank Beck, and Bent Stumpe. After that, George Samuel Hurst, an American inventor, developed the first resistive touch screen, for which he was given US Patent No. 3,911,215 on October 7, 1975. The initial version was made in 1982. [1]. Likewise, over the years touch screens have seen tremendous growth overall which some may argue that it wasn't visible up to the late 2000s but yes now we can see how major this technology has become and is one the leading industry/technology in the world.[1]

The hospital is a crucial component of a social and health institution that serves the community by offering plenary (complete), healing (curative), and disease prevention (preventive) services. Nurses, doctors, and other health professionals are responsible for delivering these services. Because nurses continuously offer care for patients, they are regarded as the leader in the organization of hospital services. The nurse keeps an eye on the patient's health and continues to treat them. Nurse callers have been the subject of numerous prior studies. Using various event simulations, Vannieuwenborg examined the techno-economic evaluation of an ontology-based nurse call system. [9] s

Standard nurse call systems fall short of providing patients, residents, and their families with safe and comfortable technology. Up to 24 wires are needed per room for a wired system, resulting in spaghetti cabling that makes installation and regular and unscheduled maintenance more challenging. Additionally, these conventional systems are unable to save information on nurse and patient behaviors, leading to the allocation of human resources without a data backup. It can frequently be expensive, time-consuming, and disruptive to install a nurse call system.[1] With wireless nurse call systems, this won't be an issue anymore. Capacitive touch screens were the first to be created. Hospitals assisted living communities, and long-term care institutions face the particular problem of managing heavy patient loads, rigorous employee timelines, and healthcare laws. These difficulties need the use of a dependable, effective nurse call system that meets the requirements of both your staff and patients. In order to improve the doctor's or nurse's ability to respond quickly and provide the patients with prompt care, the proposed nurse calling tool is used for specific communication between the devices and facilitates and organizes communication between the doctor/nurse and the patients. the parties. When a Bluetooth module, the MH-10, is included, the microcontroller ATMega8 functions as both the sender and receiver. The LCD touch display's display characters are generated by an ATMega8 CPU, which also turns on the LED and activates the buzzer to inform the nurse and doctor. [1]. This was one established way to build a nurse calling system for better and collective purposes.

It's not like we can't build such projects by using different components and methods, of course, there is a way to build such projects using different methodologies and patterns.

There are a lot of advantages too for nurse calling technology: -

1. Faster reaction times and improved communication: The wireless nurse call systems offer patients fast care, particularly in emergency situations where a quick response might be the difference between life and death. The wireless nurse call system notifies the medical personnel of the patient who needs medical assistance and provides them with the patient's precise location. The patient can be located anywhere in the care facility or hospital if they are wearing a wireless hand transmitter. a cutting-edge smartphone software that enables them to stay informed and take action even when they are not close to the nurse's station[5].

2.   Releasing the staff:

Many hospitals still use paper records, which slows down the admission of patients as well as medical investigation and diagnosis. However, healthcare administration may be improved. You can digitize healthcare management and save all data inside a cloud database connected to the hospital network by using an intelligent wireless nurse call system. And that's not all! Medical staff can rapidly store and access patient information using an IP nurse call system like Nurse Care [9]. The nurse call system, the full healthcare management system, and nursing

documentation are all connected into one device by the Nurse Tab, an interactive room touchscreen display, and the Info Tab, an interactive corridor display. From a patient's room or the hallway, nurses can save patient data and updates. The latter eliminates the need to complete paperwork and guards against data loss and duplication of information. This typically occurs when nurses enter handwritten data into the electronic form [8].

3.   Improved workflow and lesser disturbances:

A more efficient process reduces any possible waste of time, money, and expertise. Every bit of information is promptly recorded, easily accessed, and shared among medical staff when using an intelligent nurse call system. Better coordination and decision-making result from improved communication. Additionally, it aids in reducing medical errors, which have an impact on both the hospital's finances and reputation. Since nurse care offers prompt and timely patient care, there are fewer disruptions in the healthcare process. It aids nurses in maintaining organization and keeping them concentrated on patient care rather than side issues.

4.   Lesser mistakes and cost-effective:

The usage of monitoring systems benefits the medical staff as well as the hospital administration. Healthcare experts spend the day treating a number of patients. Data loss or even a medical error could occur as a result of the repetitive data transmission throughout this process.

Monitoring tools like Nurse Tab, which constantly monitor healthcare processes, help to maintain patient safety. With the Nurse Tab, medical staff can log the personnel assigned to work in a certain patient room, their arrival time, and the length of time given (c). Nursing notes, (d) the list of services provided, and (e) the patient's name [5].

When you balance the long-term benefits against the initial cost, using a wireless nurse call system makes financial sense.

especially if you can connect it to your present nurse call system and use the building's existing infrastructure. Only the features that will be most beneficial to you can be customized. [8] Satisfied staff, and satisfied patients:

Patient care that is satisfactory, attentive, and effective makes for happy, comfortable patients who are more likely to recover quickly. In hospitals and other care facilities, wireless nurse call systems to speed up the healing process, improve productivity, and lower stress levels. The simplicity of these clever ideas keeps hospital operations running smoothly and effectively.

3. Methodology

3.1 Materials/Tools Used:

1)   TFT TOUCHSCREEN: -

You have probably used a Thin Film Transistor touch screen if you've ever used a smartphone, tablet, or touch-screen computer. A TFT touch screen is a hybrid gadget that combines a TFT LCD display with a touch screen overlay. The gadget can serve as a user's interface as well as a means of displaying material. The majority of touch displays are TFTs, with Organic Light Emitting Diode screens being their sole significant rival. 2.4' TFT is being used for this project.

One of the most often utilized graphic screens is the 2.4" TFT shield. These are some of its key characteristics:

resolution in pixels of 240*320

the capacity to display 262000 various colors

includes a touchpad with a 5v power supply.

Fig -1: **TFT Module**

2)   HC-05 BLUETOOTH MODULE:

When it comes to electronics and communication, wireless connectivity is quickly displacing traditional connections. A replacement for cable connectors the electronics are communicated with by HC-05 using serial communication. Typically, a short-range wireless connection is used to exchange files between small devices like

mobile phones. It operates in the 2.45GHz range. Data can be transferred at a rate of up to 1Mbps over a distance of ten meters.

The operating range of the HC-05 module is 4-6V of power supply. Baud rates of 9600, 19200, 38400, 57600, etc. are supported. The most important feature is that it can be used in Master-Slave mode, which prevents data from being sent to or received from outside sources.
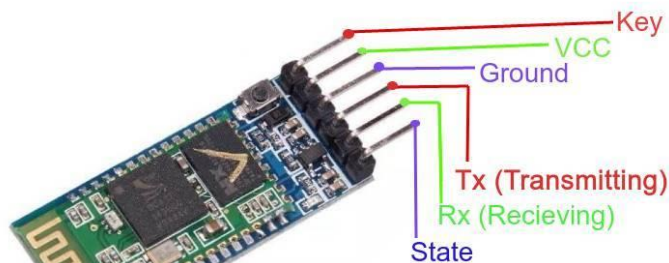
Fig -2: **HC-05 BLUETOOTH MODULE**

1)   ARDUINO UNO:

A microcontroller board called Uno is built around the 8-bit ATmega328P microcontroller. It also includes additional parts to support the ATmega328P microprocessor, including a voltage regulator, serial connectivity, and a crystal oscillator.

The Arduino Uno contains 6 analog input pins for connecting to external electronic circuits, 14 digital I/O ports, and a USB interface. PWM output is possible on six of the 14 I/O ports. It can be used by the designers to communicate with and detect actual external electronic equipment.

Since it was first released, the Arduino Uno has been a huge hit with electronics enthusiasts, ranging from newbie hobbyists to seasoned programmers. Since it is an open-source platform, anyone can alter and enhance the capabilities of the boards. Boards and software may be found easily. The software used for Arduino devices is called the IDE (Integrated Development Environment), and it is free to use but requires just rudimentary computer knowledge

Fig -3:**Arduino Board**

1)   BUZZER:

Because they may directly produce sound when attached to a battery, active buzzers are thus named. Most manufacturers tune the single tone that active buzzers can produce to 2 kHz. Passive buzzers, on the other hand,

require a wave to be triggered in order to make a sound. Thus, depending on the input frequency of the signal, these passive buzzers can create a variety of tones. All buzzer kinds have positive and negative terminals identified on them, and they are all polarized. The negative of the battery should be connected to the negative and the positive to the positive. These buzzers cannot be identified only by appearance. Attach them to the battery while paying attention to their polarities. Active buzzers emit a loud tone, while passive buzzers only make a pop sound.

Fig -4: **Buzzer**

3.2 Methodology:

The first basics of Model Building start with the list of components that we are going to use. So, we are going to: -
2x Arduino Uno Modules
2x HC-05 Bluetooth Module
1x 2.4' TFT Touchscreen Module [1]
3x 5 Volts Passive Buzzer
Breadboard
We are using 2 Bluetooth Modules as we are going to make one Master and one slave each [3]. They will act as transmitters and receivers if explained in simple words. The Master and Slave act as Transmitter and Receiver though both can transmit or transfer the data, it's the Master who initializes it. There are some specific ways to configure Master and Slave Bluetooth modules using AT commands:

Table 3.1 Configure Master and Slave Bluetooth modules using AT commands

| AT+RMAAD SLAVE CONFIGURATION	(To clear any paired devices)
AT+ROLE=0	(To set it as a slave)
AT+ADDR	(To set it as a slave) (To retrieve the address of this HC-05, remember to jot the address down since it will be utilized during master configuration) (To get the address of this HC-05, remember to jot the address down as it will be used during master configuration)
AT+UART=38400,0,0	(To fix the baud rate at 38400) (To fix the baud rate at 38400)
AT+RMAAD MASTER	(To clear any paired

CONFIGURATION	devices)
AT+ROLE=1	(To set it as master)
AT+CMODE=0	(To link the module to the supplied Bluetooth address, which the binding command can be used to specify.)
AT+BIND=98d3,34,906554	Simply enter your particular address to the slave at (now, obviously).
AT+UART=38400,0,0	(To fix the baud rate at 38400) (To fix the baud rate at 38400).

Now we configure the TFT Screen with Arduino [2]

Any Arduino Uno can utilize the shield directly. In this instance, we're utilizing an Arduino UNO, which exposes every pin on the board and on the header. so that you do not require a separate shield in order to access the pins that the screen does not use. On the board, all of the header pins are reachable and ready for usage. There is only one legal place to mount the sandwich in order to join the shield. Instead of this sandwich, we can also complete the connections with all the Jumper wires we use. This makes the project handier and more feasible. Every pin of the TFT except the two pins is connected to the Arduino and other parts by Breadboard. The three 5V buzzers are then connected parallelly on the breadboard.
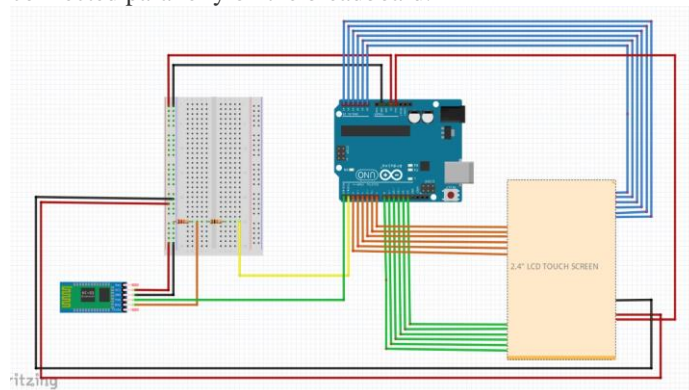

Fig -5: **Architecture of Project**
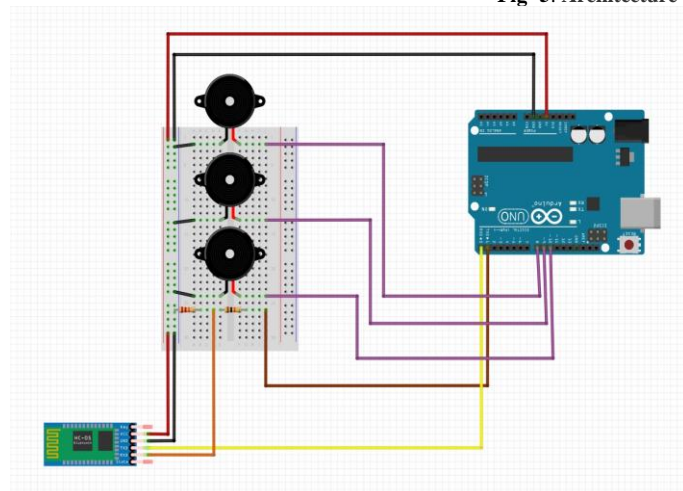
Fig -6: **Connections**

Finally, all the coding part is done along with the configuration for Bluetooth, TFT, and Arduino. Repeated configuration with testing and running helps to build the project successfully.

Now we will go through the flow chart and see how the project was implemented in various steps and how this approach will be useful when we will interact with the various industries and make this project public and in business.
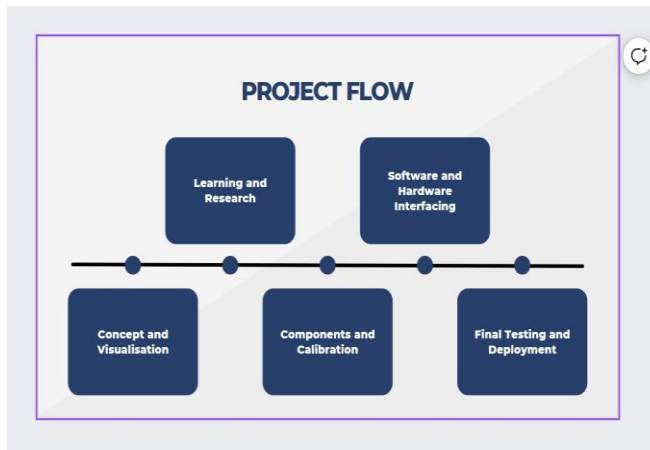

Fig -7: Flowchart of the project

3.3OBJECTIVE

1.   Nurse calling system will help hospitals to manage the chaos during the days when there are a lot of patients
2.   It will help the patients call for immediate help from Nurses and Doctors when in case of an emergency.
3.   Nurses/Doctors will get to know where in which ward, they are required most.
4.   A recent pandemic where the hospitals were getting overflown is the best case where such Nurse calling systems should have been used for better management.

4. RESULTS AND DISCUSSION

We built the Nurse Calling System for hospitals and clinics.
We have successfully implemented our system and completely tested all its functions and features. The device has a touch screen that reads user input. A rf transmitter reads the touch input and sends it to the remote receiver circuit. The input is taken in by the remote circuit, which then passes it to the microcontroller for processing. A buzzer is connected to the circuit to inform users. The single-touch system helps the patient or the other members of the patient to call the Nurse/Doctor whenever needed or in case of emergency. Whenever any person touches the TFT screen, the buzzers set off and an alarming sound is made. The delay of the buzzer is kept for a minimum of 5 seconds. We can make these buzzers in some common areas where the staff will get to know and Doctors and Nurses rush to the spot and help. These solutions will aid in raising morale and patient and employee satisfaction. Care can be given promptly by enabling medical staff to pinpoint the specific area or room a patient is phoning from.
Readings are all visible to us and not the users so that we can have records in the back end of the system. Databases should be created for all such data storage purposes and implemented in hospitals and clinics the usage of these systems will be in high numbers and a proper history is needed for further requirements.
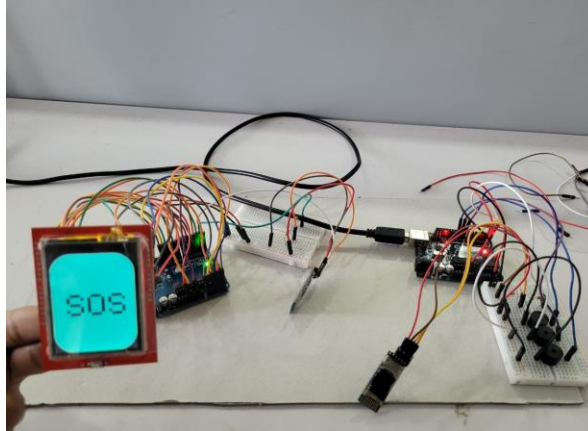
Fig -8: **Actual representation of project**
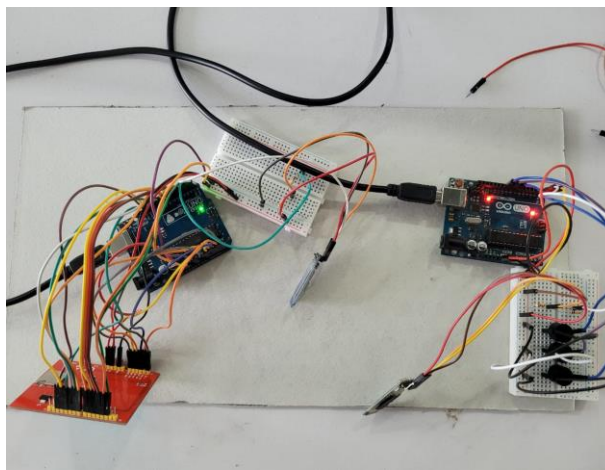
Fig -9: **Actual connections of project**

5. CONCLUSION

Our Nurse Calling System provides total flexibility and mobility, making it eternally adaptable and extendable, enabling a constant capacity to respond to continuously shifting priorities and demands also, our solution is affordable, trustworthy, and secure. It can be altered to satisfy certain requirements and demands and tailored to fit any healthcare budget. Additionally, it contains a number of features that can help to increase staff productivity and raise the standard of care provided to patients and clients of healthcare facilities.

Such systems will definitely be a boost in the healthcare industries all around the world. For hospitals that are under huge loads of patients and customers find such systems very useful and it helps in their overall management. In big hospitals these systems can be implemented in all of their rooms/wards and a proper system can be created which manages actions through and from all these rooms. If the Government provides a subsidy for such products/projects small local regional hospitals will also be able to avail of such smart facilities. Such systems can also be useful for many physically impaired people and act as a source of help to them while receiving treatments in hospitals and clinics.

Nurse calling systems have the following benefits: - Decrease weariness among healthcare workers - Cost-effective, boosting the profitability of your facility - Completely integrated communication and alarm system - Expandable - Offers quick communication - Piece of mind. The major goal of our envisioned system was successfully accomplished. In the event of a pressure fault issue, it also had a quick response time. The end result was an incredible system that was error-free. as well as made an effort to achieve a high degree of technology on a global basis.

FUTURE SCOPE

● We can add different sensors for real-time monitoring of patients and to know the exact condition of the patient.

● We can add a different button for different staff like housekeeping, emergency staff, etc.

● We can make this function more advanced by providing some necessary information till the doctor arrives.

● With the help of advanced AI/ML we can also provide aid with the help of automation till the doctor/nurse comes.

● Specific buttons for specific problems can help only necessary help from staff be provided to avoid rushing.

● These systems can be helpful to monitor the patient unless and until they are out of risk.

● We can add RFID-based switching off for buzzers to make sure that the buzzer doesn't switch off till the patient has been attended to.

● Firebase can be used to increase the range of transmission as well as send the ward numbers to the main server.

6. ACKNOWLEDGEMENT

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