

An IOT Based Nurse Calling System for Realtime Emergency Alert Using Local Wireless Network

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Abstract—In this paper, a wireless nurse calling system is proposed where any patient can call a nurse for emergency case and the notification will be received in nurses wrist band. Based on hard-wire, currently most of the emergency calling system in hospital are constructed which is costly approach. There have been an attempt to implement the calling system over wireless network but the scale of coverage was very tiny. This project is based on a unified WiFi network which highly accessible and cheap to found thus making it one of the cheapest approach in this domain. The key component of this project is a WiFi module ESP8266 and a Server. This project can be use in any kind of scale depending on the need. Our proposed system promises to deliver much higher performance and coverage while it is closing the gap between the management and workers by monitoring calls in real-time.

Index Terms—Wireless, WiFi, Network, Real-time, Call System, ESP8266

I. INTRODUCTION

Hospitals are one of the most important places on the planet. There are many emergency events occurs in the hospital every day but calling a nurse is one of the common tasks of the daily schedule. However, calling a nurse could be difficult when it comes to emergency since the whole system [3] [4] of calling a nurse is manual in Bangladesh, it's not entirely possible to send the notification right away.

As most of the hospital system is not properly managed, waiting for a nurse in a hospital bed is very stressful and causes uncomfortable situations. It hampers the nurse workflows and communication between patients and staff. Also the quality issue of a hospital gets down because of a proper calling system. There are 2277 Health Institutes in Bangladesh right now in accumulative seats count that are functioning 39751. Since this project is based on the number of beds and the hospital counts are just the client this project can server, we have a promising place to work with. As 2349 seats or beds have been proposed and there are already 39751 seats are functional, that gives this project a wide range of area to work with.

This project is propose a wireless nurse calling system. The main problem is that the terminals used in the hospital right now are hard-wired [1]thus making it untraceable when it comes to identifying call delay. This project solves it with

a widely used network which is WiFi and making the call remote so that no nurse need to wait in standby to see the incoming calls. This project making the solution a lot cheaper than hard-wired solution where it also provide the feature of other facilities such as measuring time and delay depending on the call. There has be research on effectiveness of wireless nurse calling system. The findings of the nurse call inclusion study verified that the embedded communication scheme decreased by 51% all monitoring findings by the average moment to complete a customer application. Analysis of the device utilization by clinicians for various kinds of customer applications showed that it allows clinicians to have more power over the prioritization and response to their demands based on the gravity of the occurrence. [5] And there are research on experience by nurses too. [6]

We contribute to solve this problem by bulding a network base on WiFi Modlue and a Server. The module and the server will be responsible for handling calls form diffrent beds and wards.

We talk about the overview regarding this project in section II. We talk about IOT and brief problem. We also talk about statistics and the proposed network diagram.

In section IV we talk about the how this project is doing with compared to other similar types of project. The key finding is that this project is cheap and also usable through out multiple use case and in a large scale.

In section III we talk about the detailed work methodologies of the project, we talk about each components and how they are connected together and working simultaneously. We also talk about features of each component of the project.

This project is an innovation in the sense that no other services in the hospitals of Bangladesh don't use wrist band receivers for calling purpose. This project is highly effective in any kind of hospital since it is extremely cheap to make and when it is done in mass production the cost will go even down.

II. ARCHITECTURE OVERVIEW

A. IOT

The Internet of Things is a system of interrelated computers, mechanical and digital machines, objects, animals, or people

that have unique identifiers (UIDs) and the ability to transmit data over a network without requiring interactions between people or humans.

B. Equipments

- **Power Supply:** The power needed to operate the device is about 5V that will be served by a power supply module.
- **NodeMcu ESP8266:** NodeMCU is an IoT application open source. This involves firmware on the Espressif Systems Wi-Fi SoC ESP8266 and hardware on the ESP-12 module. The word "NodeMCU" relates by definition not to development kits but to the firmware. The firmware utilizes the Lua alphabet for scripting. It is built on the Espressif Non-OS SDK for ESP8266 and was based on the project eLua. It utilizes several initiatives like lua, cJSON and SPIFFS.
- **0.96inch OLED:** OLED display to print the call notification, basically this module is the display of the wrist band.
- **Telephone Push Switch:** Button to do push that can start the service of any-kind.

C. Proposed Network Diagram

The proposed network diagram is given in figure 1. This project utilizes the widely available WiFi network. Now, when it comes to this project's contribution it boils down to the effectiveness of this project at this price point along with giving a lot of the accessibility to the user of this project. This project aims to solve the tradition lighting up the signal of the calling system in the hospital. It is putting a light in everyone's hand who's part of that system. In one click convey message throughout the staff members of the given system is such amazing that it can improve efficiency a lot.

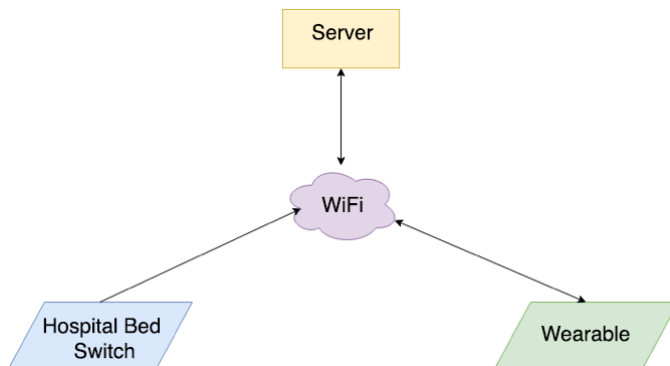


Fig. 1. Network Diagram Of Wireless Nurse Calling System

III. DESIGN

To solve various issues in the hospital, an idea is introduced that based on wireless calling system. This system will offer the most complete and reliable way that allows patients to communicate with the nurse more quickly and effectively. The patient experience can be also improved through it. Furthermore, it will help to grow the hospital business.

Through this system, patients will get more freedom and help from nurse whenever they want for like to get coffee, go to the toilet, stretch the legs etc. in time. Patients will also have more flexibility with their hospital life as they don't need to wait that much like before. As the system is smoother and quicker, the past conflicting or unpleasant situations will be reduced to almost down and everyone's life will be in peace. Hospitals, medical facilities and healthcare officers will be thankful for this idea as it optimizes patient flow by providing effective patient care.

The waiting time for a nurse will be not that much long like past. So it will decrease time waste and saves time for the next patient's care. The communication in this system is more secure and fast than any other done work. Keep tracks of patient's calling request and provides certainty for the patients, which is then less anxious and worried about being forgotten. Thus it allows more time for real/effective patient care.

This project will use IP based system to identify each place the calling is happening from and also it will track the IP of the nurses to find them in the system in order to target the call efficiently without having to have a lot of workload to other devices. The use case diagram is given in figure 3.

This project will be consisted of three major parts:

- **Caller Box:** This system proposes a caller box that will work wirelessly. The necessary information that is required will be in the box and when the button is pressed it will send the information the server through the hospital WiFi.

Features:

- Call Button to Trigger Call.
- Send information of caller.
- Read RFID and Send Information.

- **Wrist Band:** This system proposes a wristband that will function as a watch also a calling device, this device can receive notifications from the server and which will receive the calls and ring alarm.

Features:

- Receive Calls.
- Send Call Received Information.
- LCD Display.
- RFID.
- TIME and Battery Health Display.

- **Server:** This system proposes a server to service all the incoming calls and re-routing them through the portal.

Features:

- Local Server based on HOSPITAL BUS.
- Decision making based on the call.
- Segment call information.
- Extendable to Attendance using RFID.
- API to call from any other authorized platform.

The network will be built with one common component at both ends. Since, NodeMCU ESP8266 has the capability of input and output on its own we will also be building the wristband out of the same chipset which will make it much more cost efficient.

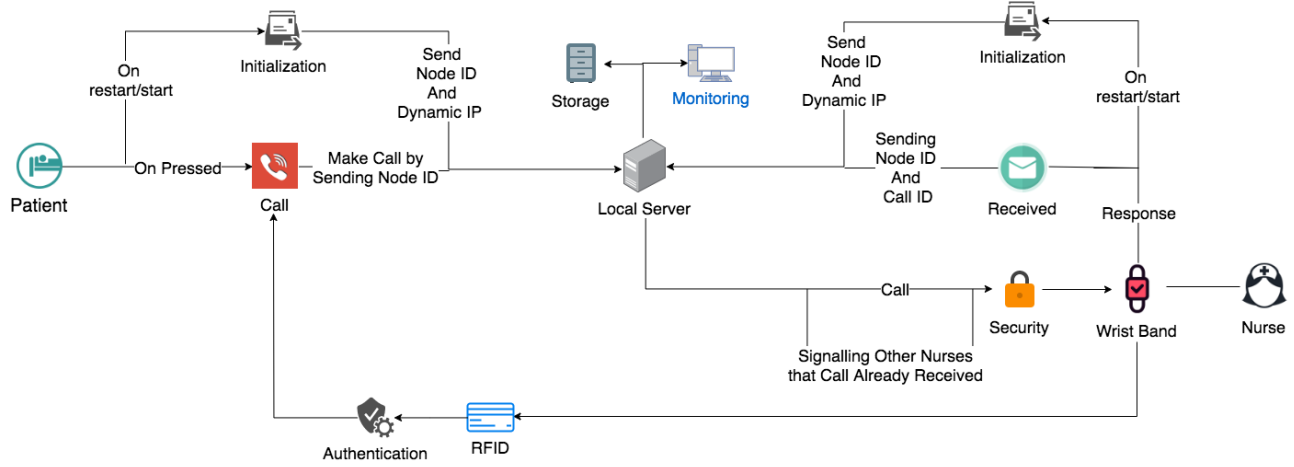


Fig. 2. System Diagram Of Wireless Nurse Calling System

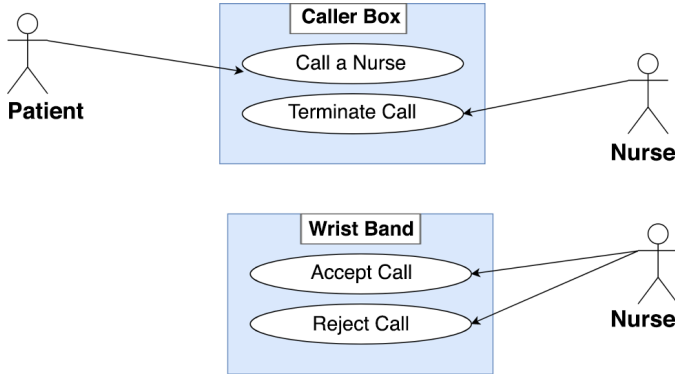


Fig. 3. Use Case Diagram of Wireless Nurse Calling System

IV. CONTRIBUTIONS & COMPARATIVE STUDY

We started with buying procurement in the table IV to build the project.

TABLE I
PROCUREMENT

Name	Particular
NodeMCU ESP8266	The micro controller for the both end communication
OLED Display	A display that goes along with the NodeMCU
WiFi Router	To create the network, we will need a WIFI router for development purpose
A PC	To setup the development server

A. Integrating Switch with Esp8266

We coded the nodemcu using arduino code to implement the caller box which is responsible to make a api post request to the server shown in

B. Building A Responsive Web Server

For receiving the call from switch and providing better response to api post request of caller box, we build a server to handled the post request using a database in the backend of our django webserver. In figure

To create a very useful calling system which low cost is the main goal of this project. This project will make the hospital experience a lot better. The user of this project will find it very convenient thus productivity will increase over time. To be able to roam a bit freely nurses can check on other people and have a lot of impact without sitting somewhere standby.

V. CONCLUSION

For many years , hard-wired solution is dominating in our hospital for calling system. Though, this solution wasn't a comfortable and flexible one, the hospital management was forcefully bound to use it. But now it is time to change the solution and use ours. Our calling system that are fully based on wireless approach. Hospitals and health care facilities deal with life and death. Every single second matters and can make the difference. Nurse call and notification systems not only need to be fast and accurate, but they must be reliable as well. The patient and caregiver each have alerts in place if needed. Smart Nurse Calling System provide the same type of simplicity and comfort. There would be no wires out in the open, and nurses could have the option of wearing a device to make the alerts even more immediate. The software in these programs can actually keep track of the response time, making management aware of any slow-moving staff members.

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