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IOT Based Nurse Calling System Using E-Glove

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ABSTRACT

The project's main objective is to develop a system that will allow patients to call a nurse or attendant by their hand movement in an emergency. A wordless individual typically uses sign language to communicate, which is not understood by most people. Flex sensors were used in the system, which operated in time with patient hand motion. A stream of data that changes with bend degree is the sensor's output. The sensor's output is digitally processed from its analogue value using a microcontroller before being broadcast through GPRS. It is then received in the receiver part and used to process vocal responses using a speaker. The simultaneous activation of sensors enables the conveyance of patient need to the nurse station **via GPRS wireless communication, where the nurse can listen what is the patient need via computer audio.**

***Keywords*—Internet of Things, Sensors, GPRS, Arduino uno.**

Introduction

Globally, there is a lack of nursing personnel. The situation is worse in both developed and developing countries. Only 40% of registered nursing professionals are actively employed, according to the Nursing Council of India (NCI). The patient to nurse ratio has decreased as a result of this. The recommended ratios for the critical care unit, intermediate care unit, and general ward are 1:1, 1:3, and 1:6, respectively. The nursing staff deficit appears more dire because of the three shifts that the nursing staff is required to work.

According to a recent survey, during evening and night shifts, the nurse to patient ratio in many public hospitals is roughly 1:60. This strains the nurses who are working. The above-mentioned problems significantly impede patient care and have been found to be key deterrents for nurses to join the nursing service. In order to help ease the strain on nurses, a low-cost nurse calling system has been developed as part of this project. This smart device is made up of an electrical conditioning circuit and a glove with flex sensors. Selective regulation is the result of its finger-bending. The creation and application of a finger position measurement system for one hand is the main goal of this research. The medical application has been highlighted here, highlighting the closeness between the patient, doctor, and nurse. It can also be utilized for treatment.

PROPOSED WORK

The E-glove is a typical driving glove made of fabric that has flex sensors on the thumb, each finger, and along the length of each finger. The sensors produce a stream of data that fluctuates depending on how far the bend is. The sensor's output is an analogue value that is converted to a digital representation and processed by a microcontroller before being communicated through GPRS. It is then received in the receiver portion and processed before being translated into speech by a speaker. Flex sensors, which vary resistance based on the degree of bend on the sensor, are a key component of this paper. They convert the change in bend to electrical resistance, with the resistance value increasing with the amount of bend.

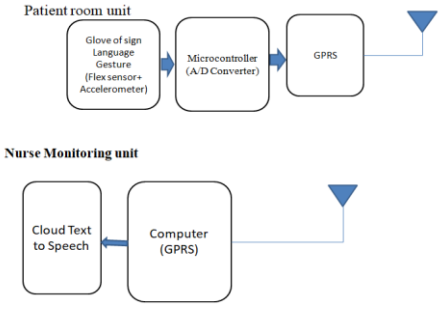


Fig. 1. E-Glove Block Diagram

Patient room unit

Fig. 1 shows the E-Glove Block Diagram which consists of patient room unit and Nurse Monitoring unit. In patient room unit, patient who in danger or in need of medical assistance can use gesture movement if they are really sick with another reason can notify nurse and other receiver by giving appropriate gesture can sense by devices and alert nurse by sending audio message of patient name and room number through GPRS and Nurse can urge if it is emergency.

Nurse Monitoring unit

The patient data such as room number and patient name can be display in computer monitor and this is the message which notifies the staff that patient in emergency of need in medical assistance.

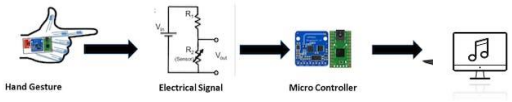


Fig. 2. Nurse Calling System

Fig. 2 Shows the Nurse Calling System it consists of a hand glove (with Flex sensors), a GSM module, and a Microcontroller as a controller. All gestures performed by the hand glove (with Flex sensor) are converted into various messages and commands for the operation of various devices.

HARDWARE REQUIREMENTS

Arduino UNO

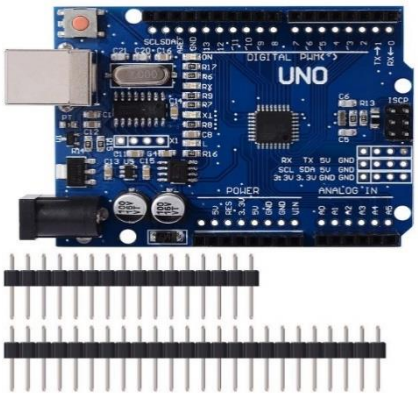


Fig. 3. Arduino UNO R3 SMD Board

A development board built on the ATmega328 is the Arduino UNO R3 SMD Board With ConnectorIt contains a 16 MHz ceramic resonator, six analogue inputs, and fourteen digital input/output connections, a USB port, a power jack, an ICSP header, and a reset button are included. It includes everything needed to support the microcontroller; simply plug in a USB cable, an AC-to-DC adapter, or a battery to get started. The Arduino UNO can be powered by either an external power supply or a USB connection. The power source is selected automatically. External (non-USB) power can be supplied by a battery or an AC-to-DC adaptor (wall wart).. The board can be powered by a 6 to 20 volt external supply. Whenever a supply is less than 7, The board could be unstable if the 5V pin delivers less than 5V. The voltage regulator could overheat and harm the board if more than 12V is used. The suggested range is between 7 and 12 volts.

Flex Sensor

Fig. 4. Flex Sensor

The flex sensor, which is used to evaluate how much deflection or bending has occurred, is depicted in Figure 4.The sensor looks like a small plastic film that has had a thin layer of copper metal applied to it.The sensor's resistance will alter when the plastic strip holding the carbon surface is turned aside. It is also known as a bend sensor as a result. Because the amount of turn can immediately relate to the resistance's variation.

GPRS

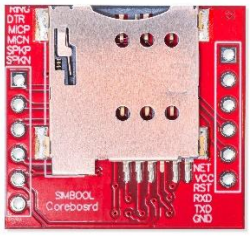


Fig. 5. GPRS Module

The GSM/GPRS Modules are one of the most often utilized communication modules in embedded systems, as seen in Fig. 5.Communication between a microcontroller (or a microprocessor) and the GSM/GPRS Network is made possible via a GSM/GPRS Module. GSM is an abbreviation for Global System for Mobile Communications, and GPRS is an abbreviation for General Packet Radio Service.

SOFTWARE REQUIREMENTS

Arduino Software (IDE)

With the Arduino Software (IDE), writing code and uploading it to the board while offline is simple. It is recommended for users with slow or no internet access. This software is suitable with any Arduino board.
There are currently two versions of the Arduino IDE: 1.x.x and 2.x. In terms of speed and power, the IDE 2.x is a brand-new substantial update that outperforms the IDE 1.x.x. In addition to a more modern editor and a more dynamic layout, it contains advanced capabilities to assist users with writing and debugging.

Sublime Text

Shareware text and source code editors for Windows, macOS, and Linux are offered by Sublime Text. Numerous markup and programming languages are supported natively. Users can personalize it with themes and increase its functionality with plugins, which are frequently created and maintained by the local community under the terms of free software copyrights. Sublime Text includes a Python API for use with plugins. The editor has a simple interface and offers features for programmers like a terminal output window, adjustable syntax highlighting, code folding, support for regular expressions in search and replace, and more. It is proprietary software, although there is a free evaluation version available.

DESIGN AND IMPLEMENTATION

Many embedded systems have substantially different designs according to their functions and utilities. In this project design, structured modular design concept is adopted and the system is mainly composed of a single microcontroller, Flex sensor and GPRS.
The system consists of 3 main stages:

Detecting input signal using sensors through hand movement

The prototype module is a wearable device containing flex sensors and GPRS. In an emergency, the patient can communicate their need for assistance to the nurse by making gesture (hand) motions. These gestures communicate the type of assistance needed, and corresponding commands are created for each gesture.

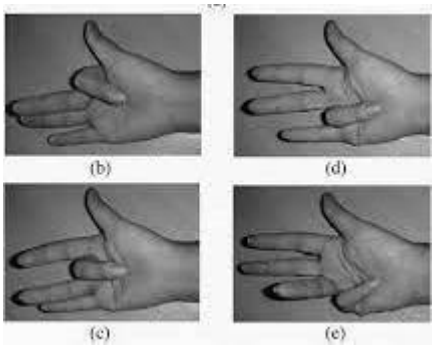


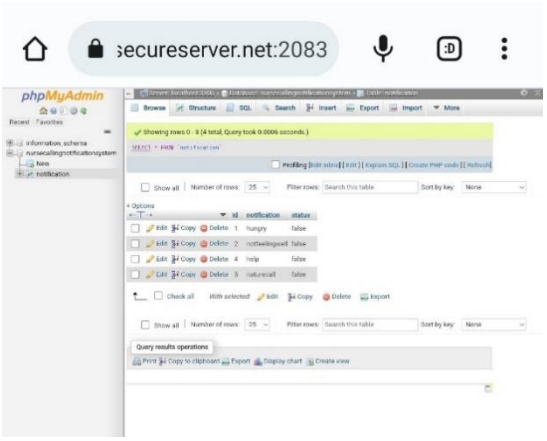
Fig: Hand Gesture Example
b) Hungry c) Not Feeling well d) Help e) Nature Call

Sending the generated input signal to nurse monitoring unit using GPRS

The project's overall control system is formed by the microcontroller at its center. A programme that is embedded within the microcontroller enables it to respond to inputs provided by the output of the sensors and communicated to the nurse control unit via GPRS.
A mobile communications standard known as GPRS uses packet-based technologies to enable reasonably fast data transfer over cellular networks. Normally configured as a transmitter, it quickly modulates and sends the signal to the nurse monitoring system.

Display of patients details in nurse monitoring unit and generating audio message

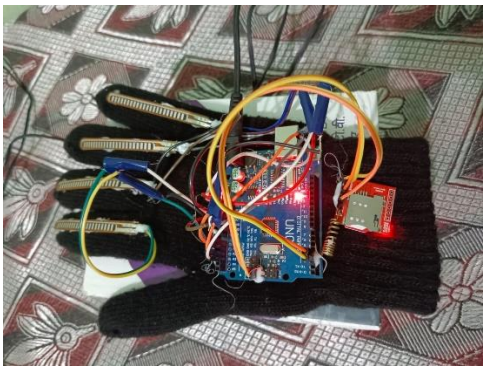
The nurse monitoring system is actively set to receiver mode; patient information, including patient name, room number, and the type of aid required, is shown on the computer monitor and also generate the audio message, alert the staff to the patient's emergency need for medical assistance.
The web server, which is a piece of software that offers data-based services using the HTTP or HTTPS protocol and sends data in the form of web pages, stores the information that was exchanged with the nurse.
The web server will upload any data it receives to the database server. Only the management and on-call physicians of a specific hospital may utilize this.



EXPECTED OUTPUTS

During the implementation, all the three sensors are connected to microcontroller using jumper wires. Once the connections are made perfectly, then microcontroller takes inputs from two sensors (Flex sensor). Flex sensors are placed on fingers which measure the bending of fingers according to the gesture made with the glove Generating commands based on gesture movements

- Sending information through GPRS to nurse for generated gesture movements.
- The details of the patients is displayed on the mobile or computer monitor
- Generating Audio Message



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