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# GESTURE BASED CALLING SYSTEM

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***Abstract- The interaction between a nurse and patient depends majorly on the communication medium. The augmentation of the Internet of Things (IoT) in the recent era allows us to accommodate this technology in various aspects of our lives to make the process secure and reliable. We are using the knowledge of IoT for making this interaction system secure and easy to use. By introducing hand gestures for calling the attendee makes this device convenient to operate by the differently abled people. From this perspective, this paper presents a real-time nurse calling system based on the performed hand movements. Further, the gesture is detected by the accelerometer and processed by the micro controller. The corresponding message is sent to the attender's smartphone, and the nurse responds at the earliest. The device uses low-cost components such as Raspberry Pi, accelerometer and a heartbeat sensor.***

***Keywords - Gesture, Raspberry Pi, Mobile application, Accelerometer.***

## I. INTRODUCTION

Internet of Things, a term which is referred to a network of devices, is emerging at an exponential rate since it came into action. IoT can be amalgamated with other domains such as Artificial Intelligence and Machine Learning to make new devices/products for specific as well as general use. It can also be integrated with embedded systems such as a micro controller to make high-performance systems. IoT is a unique branch which can be used to perform domestic operations as well as those which has a high impact and the accuracy should be on the peak.

The major characteristic of IoT is the level of compatibility that it offers. IoT blends in with almost all the domains like colours do in water. It plays a vital role in various sectors such as

 

communications, networking, research, household, and automobile. Hence, using it in the health sector can make a huge impact on the way a patient is diagnosed and treated. One such arrangement is the Gesture based calling system which uses IoT to improvise the already existing calling system.

As this device is used in hospitals/nursing home, any type of system fault or human ignorance may result into unfortunate events. Implementation of a realistic, feasible and real-time remote calling system is a necessity. A cloud interface is used as a database storing entity. The whole system is designed in such a way that it is scalable and robust. Additional features include a heartbeat sensor and a GPS, allowing the user to find his/her pulse rate and GPS for sending the user's accurate location to the caretaker.

A spectrum of ideas has been enforced in the field of remote calling system. A wired system is proposed in [1]. Space-bound remains a massive disadvantage for the system proposed in [1]. In this system, the user is bounded to a particular zone as the device cannot be carried everywhere. To overcome this drawback, we are making a portable system which a user can wear around his/her wrist, hence not compromising with his/her mobility. Similar calling system is proposed in [2] which works through Bluetooth and voice commands. The limitation of this system is that it works through Bluetooth which has a working range of 30-40 meters, again making the system bound to a limited range. Hence, to outdo this disadvantage, we are using a cloud interface that is not limited to a certain radius.

While proposing a new methodology, the key objectives that have been taken into account are the flexibility of the user to use the device from any location i.e., not compromising with the mobility of the user and deploying a system which can be used both by the user and staff member regardless of the distance between them.

## II. FORMER WORK

Nurse calling system has been constantly valuable for those who are physically challenged. The fundamental objective of this nurse calling system to make the life of differently abled people easier by providing them with the help required.

### *A. Analysis on existing nurse calling systems*

Various methods have been proposed in the field of healthcare but for situations where physically challenged person needs extra care and support to live their lives in a more facile way we need to deploy a framework with stronger stability, cost, and ease of operation. Numerous ways to deploy a model of nurse calling system are already available in today's world.

One way is the "Real-Time Feedback-Centric Nurse Calling System with Archive Monitoring using Raspberry Pi" proposed in [3]. In this system, the user will be able to call the caretaker for assistance by pressing a designated button. After this, the device sends a notification comprising of patient's bed number, floor number etc. to the nurse station. The Nurse will respond to the user accordingly and can optionally call for more help by pressing the desired button within the device. This system reduces the response time of the nurse. But the drawback within this system is that the device is connected via cables which makes the device inconvenient to be carried everywhere.

Another system "Design Development and implementation of wireless nurse call station" proposed in [4] helps in assisting the users who are physically impaired or bedridden and have no

 

means of communication when the caretaker is not present nearby. In this system, a push button is mounted near the user bed which provides the user to inform the nurse station. A call can be initiated both manually as well as automatically. An automated call is initiated when parameters such as ECG, pulse rate vary frequently in an unreasonable fashion. This system reduces the risk factor by automating the device in case of emergency. But the system compromises with the mobility of the user as the push button is attached near the bed. so inflexibility of the system becomes an immense drawback.

Another approach for nurse calling system is "Battery less Radio System for Hospital Application" proposed in [5]. This system does not require the use of long wires and battery to provide energy. The system proposed in [5] converts the mechanical energy which is resulted for user pressing a button, which is further transformed into electrical power with the help of mechanical energy converter. This device works on a radio signal which is then sent to the receiver module accordingly. The complexity of this framework is the complication of pressing a button by a differently-abled user or in case of an emergency. As well as there is no automated call in case of severe emergency.

Final analysis was done with "Design Development and Implementation of wired nurse calling system" proposed in [1]. This methodology of nurse calling system used a trigger button which is attached to the patients bed. The button when pressed by the user is followed by alerting the nurse station with a buzzer sound. This system has the ability to work with numerous number of beds with the help of RS-485 protocol.

The analysis of existing nurse calling system encourages us to deploy a framework which is more reliable, scalable, and cost effective than the existing ones. All existing techniques where either space bounded, wired or had mobility issues. The system deployed by us is a wireless system, which works with the help of cloud interface to exchange information. This makes the system easier to use and manage.

## III. METHODOLOGY

Figure 1 shows the general architecture of the proposed system. It primarily consists of two major components:

A) Transmitter side which is coupled with the user.

B) The receiver side which is in the form of an android app.

Both of these components are linked with each other with the help of cloud interface. The cloud interface helps the system components to interact among them by exchanging useful information.

*A) Transmitter side:*

The system includes an accelerometer, raspberry pi micro controller, GPS locator and a heartbeat sensor. Accelerometer acts as an interface between the user and the micro controller. The hand gesture of the user is detected by the accelerometer and is further processed and sent to the micro controller. This is a crucial part of the proposed methodology. The micro controller is built to

 

detect four gestures which can be further extended. All these four gestures are used for different purposes, such as:

- The first gesture can be used for the basic necessity like water, food, etc.
- second gesture can be used for cleaning purpose.
- Third gesture can be used for medical help.
- Fourth and the last gesture can be used in emergency purpose which alerts the staff to reach the user as soon as possible.

These are the four gestures which are initially defined by us and can be changed in future accordingly.

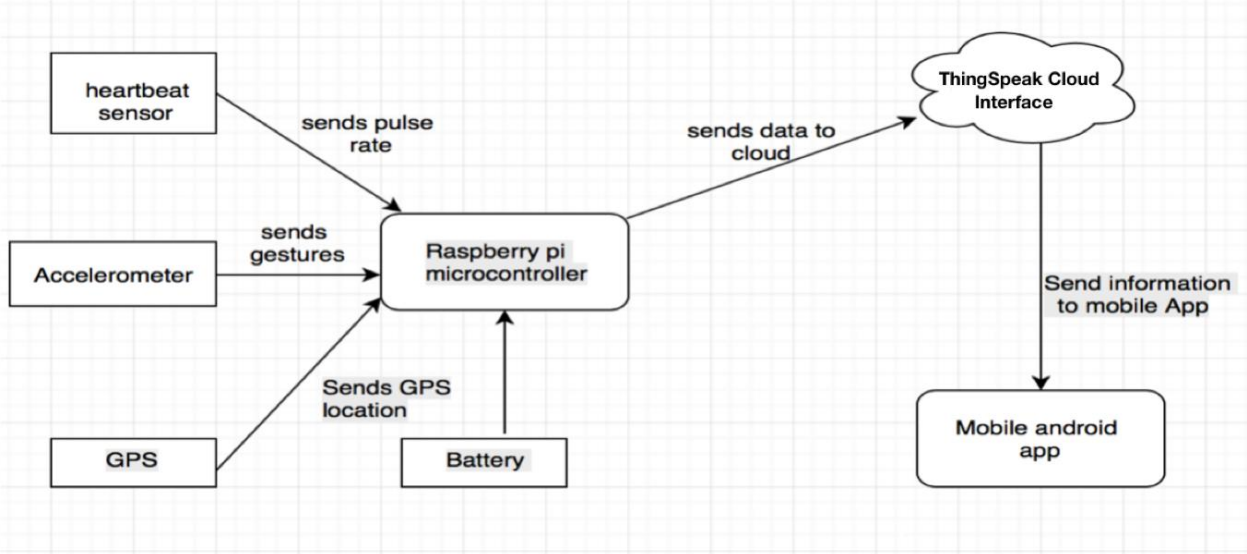


Figure 1. Proposed System Architecture

As soon as a hand gesture is detected by the accelerometer, it processes it and converts the gesture into coordinate values and sends this information to the micro controller. Micro controller after receiving information from the accelerometer, processes it accordingly, and initiates the GPS locator and heartbeat sensor to send GPS location and pulse rate. It then combines all the information sent from GPS locator, accelerometer, and heartbeat sensor, which is sent further to ThingSpeak cloud. The flowchart of the transmitter side is shown in figure 2.

 

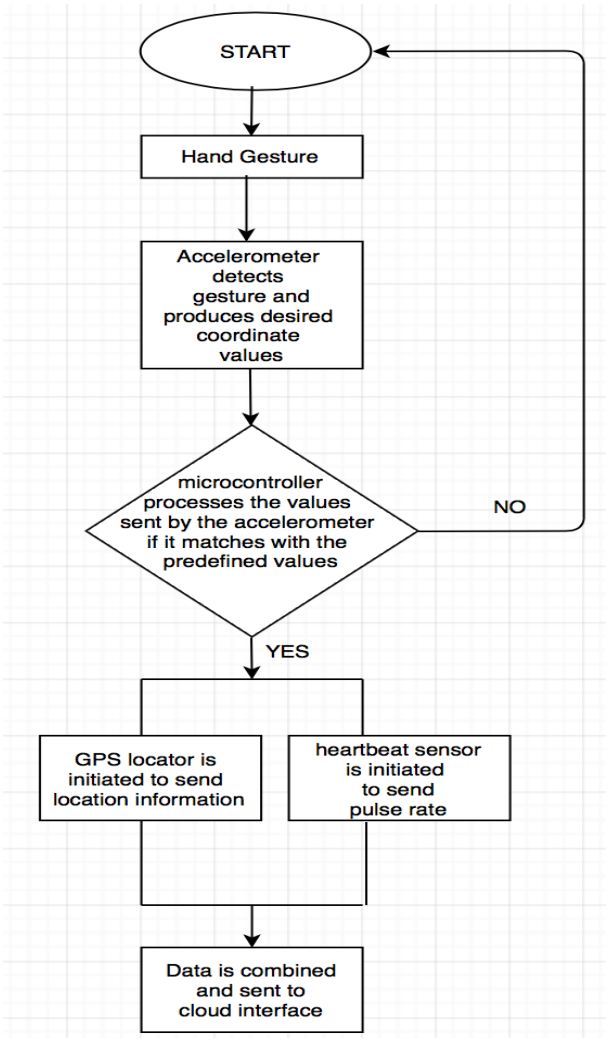


Figure 2. Flowchart of transmitter side

*B) Receiver side*

Receiver side comprises of two components: cloud server and the web application. User's hand gesture which is sent to cloud interface in form of structured data is then transmitted to web application which acts as an interface between the user and the staff member. Data is received in the web application in the form of

notification messages. A buzzer sound is followed by the notification to alert the staff member. The flowchart of the transmitter side is shown in figure 3.

 

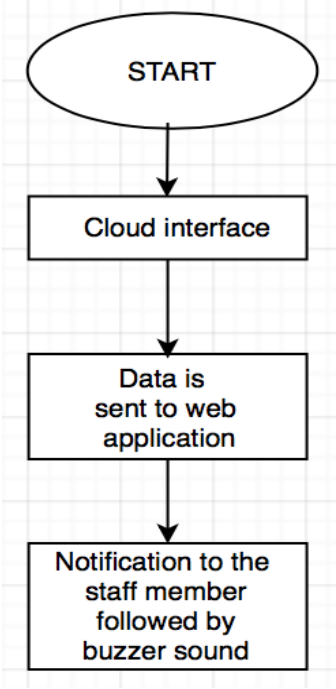


Figure 3. flowchart of receiver side

## IV. SYSTEM IMPLEMENTATION

The prototype of gesture based calling system was implemented in two parts:

A) Software Development

Software design of our system mainly includes the mobile application which acts as an interface between the attender and the user of our system for various events such as notification from the user, tracking record and emergency situations. The app is created using Android Studio and is compatible with any android device such as mobile and tablet. The app assigns individual login ID and password for each staff member. A new staff member can create their own login ID and password by filling up the mandatory credentials. The back end for the app is created using MySQL. Back end that is MySQL consists of login ID and password of each staff which is verified every time a staff logs in into the app. If the login credentials do not match to that available on MySQL database, the access to android app in denied. While creating new login credentials the back end database is verified whether the staff exists or not before assigning unique login credentials to the staff. After the staff had logged in on the app, it consists of a home page, that displays the current and previous notifications. Every notification is assigned a buzzer tune to alert the staff. For emergency notifications, continuous buzzer sound is played to inform the attender about the emergency and to respond according to the protocol.

At the user's end, micro controller, Raspberry Pi is responsible for all the functions. It is made functional by implementing an algorithm which manages all the tasks in an efficient manner. It is coded in Python. The main reason for choosing Python is its compatibility with Raspberry Pi. It

 

also has less redundancies compared to other programming languages. In simple words, we are teaching the micro controller how to respond for each type of event occurred.

B) Hardware Design

Hardware design includes six components:

1. Micro controller - Raspberry Pi

2. Accelerometer

3. Heart beat sensor

4. GPS

5. Battery

6. Smartphone

Micro controller acts as the brain of the system, managing the tasks simultaneously. All the user end components are connected to micro controller with the help of various in built ports. Accelerometer takes the main input from the user, analysing the hand movement and sending the gesture details to the micro controller. Every accelerometer will be having a unique ID which will be sent as an information to the android application making it more easier for the staff to identify the user of the system and reach out to them at the earliest.

Heart beat sensor is to find the pulse rate, by placing it on the finger. It requires some backend calculations, and displays the result on the LCD attached to the micro controller.

GPS is used to give the accurate location of user to the micro controller which sends it to the smartphone along with the notification.

The device is powered through a battery, making the device portable. This is one of the major advantages of the proposed system. Smartphone is on the receiver's end of the system. Any android based device can be used for this purpose.

## V. CONCLUSION

In this paper, a gesture based calling system is proposed. Using gestures for this purpose is a new appealing concept. The system is equipped with various components, adding more features to the device. The cloud interface increases the usability range. A heart beat sensor has never been used before for such devices, making the system one of its kind. As the system is battery powered, the user's mobility is not compromised. Raspberry Pi is used to make this system robust and scalable. Hence, this system can make a positive impact in health sector, old age homes and for physically challenged people.

 

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