Motion Based Message Conveyer System for Differently Abled

Aparna U, Amal Babu, Anjali Radhakrishnan, Joseph Ronald

Abstract: ***The main aim of motion based message conveyer system for differently abled is to implement a low cost reliable system which will help to establish communication between paralytic or disabled patients and a nurse. A patient can easily send messages to the nurse by just tilting an accelerometer connected to any of the body part capable of movement. This angle of tilt is measured and sent to a central controller which then initiates communication between the patient (transmitter) and nurse (receiver) and also decides which message is to be transmitted based on the tilt angle. Each patient will have such a device installed on his body part and all such patients will be centrally linked to the receiver at the nurse side. The project provides a reliable, effective and simple yet important solution to various issues faced by nurses in traditionally communicating with disabled patients.***

Keywords: IDE, VDT, ADC, Gesture.

I. INTRODUCTION

Among the large number of advancements done in the field of medicine, very few actually focus on helping patients with disabilities for communication. Although monitoring systems make it easier for doctors to collect and observe a patient's vitals, there aren't many options for actual verbal communication between disabled patients and doctors. The main purpose is to replace the conventional approach of patient-nurse communication with modern technologies that provide a much faster and reliable way to establish the communication. In the current scenario, the patient has to be dependent on any family member or mostly a nurse both of which have to attend to the patient constantly.

The motion based message conveyer system will not only help the patient but also ease out the nurse's job. As a single nurse is responsible for a number of patients, the time required for each nurse to visit every patient to meet his needs will be saved to a large extent. After the patient sends the message the nurse can remotely monitor their requests and provide assistance without any further delay and hence save time. To make the system more dynamic and decisive a real time medicine reminder is implemented to assist the nurse in her daily routine by providing time and medicine for the patients. All these ideas together thus focus on building a smart system to make patients self-sufficient, and also assist the nurses.

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II. DRAWBACKS OF EXISTING SYSTEM

Nearly everyone in our society faces problems and difficulties at one time or the other. But for those people with disabilities, barriers can be more often and have greater impact on them. Communication barriers and difficulties are experienced by those differently abled people who are affected by problems related to hearing, speaking, reading, writing, and or understanding, and who use different ways to communicate compared to those people who do not have these issues.

Examples of communication problems may involve:

- Written health related issues in the form of messages with barriers that may prevent people with vision impairments from receiving the message. These include
  - Use of small print that a person with weak vision cannot see, and
  - No Braille for blind people.
- Auditory health messages may not be accessible to people with hearing issues, including
  - Videos that do not contain captions or subtitles, and
  - Oral communications without accompanying manual interpretation such as, American Sign Language.
- The use of technical languages, long sentences, and many complex words may be significant barriers for people with intellectual impairments.

Even if there is proper mode of communication, it may lead other problems also:

- No verbal communication
- Waste of time
- Difficult for the nurse

III. METHOD

To overcome all the above drawbacks and meet the requirements of the system, we propose a system which mainly consists of a transmitter and a receiver section. In the transmitter section (at the patient side), a two axis accelerometer will be placed on the finger of the patient. This accelerometer is capable of measuring the static acceleration due to gravity and thus finding the angle at which the device held by the patient is tilted with respect to the earth. Whenever patient needs any help he tilts the accelerometer in different directions possible. This acts as an input to the accelerometer while output of it is in volts that is connected to the controller board which acts as the processing unit in the system.

Accelerometers which are used for the measurement of acceleration come in many types using different principles of operation and they measure acceleration not by calculating how speed will change with respect to time but by measuring force.

The sensing element inside a piezoelectric version of the accelerometer is a crystal which has the property of emitting a charge when it is subjected to a compressive force.

In an accelerometer, this crystal is bonded to a mass such that when the accelerometer is subjected to a force 'g', the mass compresses the crystal which will emit a signal and this signal value can be related to the imposed force 'g'.

Figure 3.1 shows the internal structure of an accelerometer. The sensing element is accommodated in a suitable sensor body to endure the environmental conditions of the particular project under consideration.

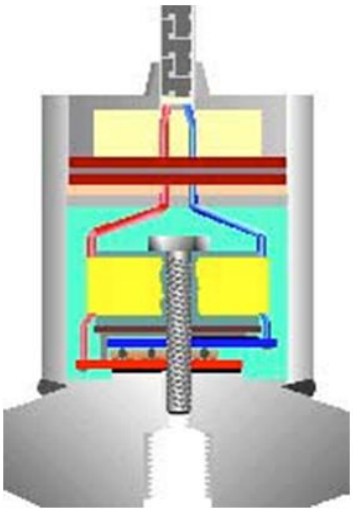

Figure 3.1 Structure of an Accelerometer

The sensor body is usually made using stainless steel with welding of the various parts to prevent the entrance of dust, water, etc. The electrical connection can be established through a sealed cable or a plug or socket arrangement. Many existing accelerometers consists of internal electronic circuitry to give outputs which can be directly used by the associated attainment or the control systems. Mechanical fixing of the sensor is an important factor in order to accomplish the true transfer of the vibration or acceleration. Accelerometers are used in many scientific and industrial applications such as predictive maintenance, aerospace, automotive, medical, process control, etc.

Figure 3.2 and Figure 3.3 depicts the transmitter and receiver side respectively. The transmitter side consists of the accelerometer and the receiver side consists of microcontroller and the display.

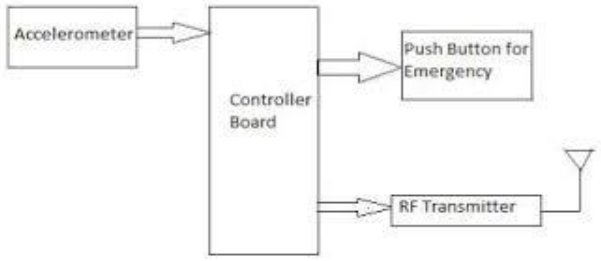

Figure 3.2 Transmitter System Architecture

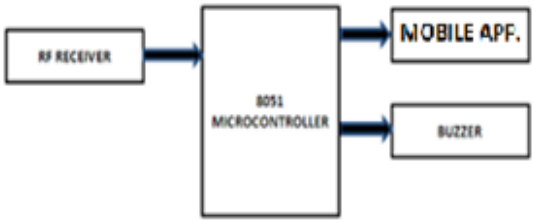

Figure 3.3 Receiver system architecture

The output of the accelerometer depends on the angle of tilt and is read by the controller. The controller maps the input voltages between 0 and 5 volts into integer values between 0 and 1023 as an analog data from the range of 0-1023. To reduce the complexity and provide a simple way for the patients, we reduced its sensitivity by mapping it to 0-5 volts and then provided a range for front, back, forward and backward so that the wide change with slight change in tilt angle will be minimized. These directions can be easily understood and used by any person using his/her wrist or any part of the body capable of moving in these directions.

Figure 3.4 is the use case diagram which depicts the various design modules in the system including the user side accelerometer and the nurse side. The sensors are used in order to measure the statistics of motion of the accelerometer. It then passes on this data to the micro controller and the micro controller processes the data and displays the particular message on the screen as per input obtained. The micro controller now displays the associated message on the mobile screen. The patient motion recorder device consists of an RF transmitter in order to transfer the data signal according to the input. An RF receiver on the other side receives the data sent by the transmitter and then decodes it before passing it to the micro controller for processing the input and responding to it. A patient can easily send messages to the nurse by just tilting an accelerator connected to a body part that is capable of movement.

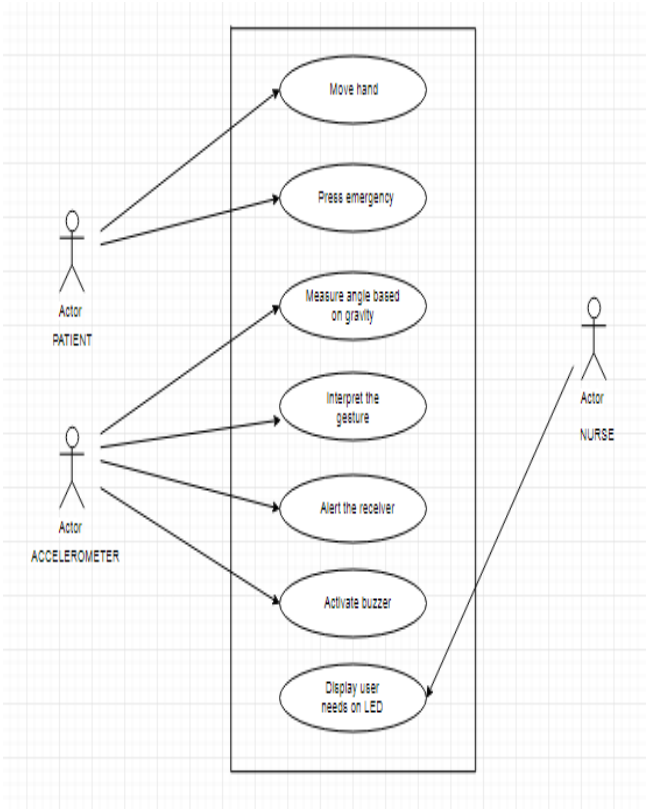

Figure 3.4: Use case diagram

A predefined message corresponding to the basic needs of the patients and those required for emergency will be stored in the ranges assigned to a particular direction as mentioned above. For example: food is the message displayed when the patient moves his finger to the right. So on tilting the accelerometer to the right, it will send the input value to the controller.

If this value lies between the range assigned to the right direction the predefined message that is food in this case will be sent to the next module that is the RF transmitter module. The RF transmitter becomes active when a message is sent from the controller for transmission when the tilt occurs.

RF transmitter and receiver works on the frequency equal to 434 MHz. The accelerometer will be connected to each patient and each patient will have a controller board and transmitter for sending his messages while in need of help. For identification of different patients their name or number is sent to the nurse if he has to handle two or more number of people by which all these transmitters can be connected to one RF receiver centrally which works on the same frequency as the transmitter. Thus the proposed system will provide a many to one communication among the people.

At the receiver side, RF receiver will receive the message and send it to the controller board which will then display the message on the mobile screen using the mobile app.

A mobile application is a software application that is created mainly to run on any mobile device such as a phone or a tablet or even a watch. Apps were originally envisioned for productivity support such as Email, calendar, contact databases, etc. However the public mandate for apps caused hasty expansion into other regions such as mobile games, GPS and location-based services, order-tracking, and ticket purchases, such that there are now lots of apps available. Apps are commonly downloaded from application distribution platforms, such as the App Store (iOS) or Google Play Store which are operated by the owner of the mobile operating system. Some apps can be free, and others may have a price. Mobile applications frequently stand in contrast to desktop applications which are designed to run on desktop computers, and the web applications which run in mobile web browsers rather than straight on the mobile device. A mobile app is created which will display the message that is to be conveyed by the patient to the nurse or the doctor.

The transfer of message from the system to the mobile application is done using a Bluetooth module. Bluetooth is a wireless technology and is more convenient for usage compared to connection cables because of several reasons. When the nurse travels with the mobile then there will not be a need to carry the connection cables. Secondly, the cost of the Bluetooth is not very expensive. The Bluetooth modules can connect with the same as well as with different Bluetooth projects and hence they are said to be standardized. The Bluetooth module can automatically connect with any another Bluetooth device that is located within a building that is at a range of 30 feet. The energy consumption by the Bluetooth devices is very less especially in mobile phones.

On reception of the message, nurse will remotely take the required action to meet the needs as per the message. In case of emergency the patient has to just press a push button which will signal the processing board to send an emergency alarm to the receiver informing the nurse thereby activating the buzzer. This will help the nurse to take care of the emergency sent by the patients as soon as possible.

The advantages are:

- The motion based message conveyer system for differently abled helps to enable the easy communication between the patient and the nurse.
- This will make it easy for the nurse to assist the patient, and can be involved in any other jobs too.
- There will not be any waste of time as the nurse will know the exact time as to when the patient is in need of any help.
- Since the materials used are not very expensive, it is of low cost and power consumption.
- As the materials used are of light weight, it is portable and can be placed anywhere on the human body.

IV. RESULTS

The motion based message conveyer system is fully automated, reliable, and convenient for everyone. The simulation of the system is done using the Arduino software.
The message to be conveyed to the nurse or the doctor by the patient will be based on the variation in the angle of tilt, that will be sent from the accelerometer to the mobile app at the receiver side with the help of a Bluetooth module.

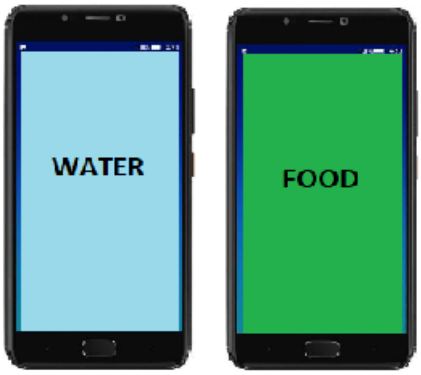

Figure 3.5: Mobile App displaying the messages

The project shows the successful transmission of mainly four different messages. One of the most effective function of the system is that the message given by the patient can also be heard through speakers. As well as the message is remotely sent to doctor of concerned person in a mobile application. When accelerometer is titled to right side then the message displayed is “FOOD”, when the accelerometer is tilted to left side then the message displayed is “WATER”, when the accelerometer is tilted downwards then the message displayed is “MEDICINE” and when the accelerometer is tilted in upward direction the message displayed is “EMERGENCY”.

The motion based message conveyer system result shows successful transmission of four messages from each patient. This window will be present in the form of a mobile app at the receiver side that is at the nurse side. As soon as a message due to the motion of accelerometer at the sender side is received it will be displayed on the mobile screen. Identification of the message from different patients is made easy as patient number is sent along with the message to the doctor. Hence multiple patients can be handled and served using the system.

Figure 3.5 depicts the mobile application on the mobile device that shows the messages to the nurse at the receiver side.

The message will be displayed successfully on the mobile screen. The app has been created to simplify the tasks of the nurse, and hence displays each of the message on separate different coloured screens of the same mobile device. This means that the message ‘Water’ will be displayed on a blue screen whereas the message ‘Food’ will be displayed on a green screen and so on.

This will help the nurse to understand the patient needs just by viewing the colour instead of reading the message.

V. CONCLUSION

The Motion Based Message Conveyer System for Differently Abled, has made conveyance of message possible only by the motion of a body part. The ease of message conveyance without actual oral communication is the main advantage of this system. By implementing this system a simple device for paralyzed or disabled people can be achieved without the use of any complex form of inputs. As Bluetooth module is implemented in this system, for a large area and transmission distance the type of communication used have to be more effective and faster. Our system successfully proves that this system is an excellent approach to be implemented at hospitals to facilitate patient-nurse communication. The project can be further developed into an automatic wheel chair wherein the wheelchair can be moved just by hand gesture. The system can also be embedded within the wheelchair such that the patient can move around using the wheelchair just by moving any of the body part and also transmit the messages to the nurse if in need of help.

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