# WIRELESS COMMUNICATION DEVICE FOR PATIENTS RESTRICTED TO BED

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**Abstract**

As technology progresses, there's a push to leverage emerging technologies across various fields to enhance human well-being. One such area is healthcare, where the Internet of Things (IoT) plays a crucial role in connecting accessible medical resources to offer patients intelligent, sustainable, and efficient health services. The proposed method involves collecting sensor data through the Arduino microcontroller, transmitting it to the cloud for analysis, and then remotely viewing the results. The remote healthcare system operates in two main stages: first, sensors detect vital signs, and second, data is transferred to cloud storage. For patients confined to bed due to pain or other reasons, constant monitoring is essential but physically challenging for caregivers. With this technology, patients can communicate with medical professionals using hand signals, while SMS alerts notify hospital staff, enabling remote monitoring from any location.

**Keywords:** Gesture sensors, Audino, Patient, monitoring, Vital check

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## I. Introduction

In hospitals and nursing homes, there are often patients who struggle with day-to-day tasks and rely on assistance for medication, mobility, and other needs. Staff members face challenges managing various tasks of different priorities, especially as the number of patients or residents increases. Despite their training, staff members can't be present with every individual at all times. To address this workload, we've developed a device that alerts staff when a patient needs assistance, without hindering the user in any way. This approach is designed to be user-friendly and adaptable, using technology that is both appealing and scalable. Gesture control, seen as the future, minimizes the energy required for tasks. By making simple gestures, users can signal their needs to staff, streamlining the process and reducing the need for constant supervision.

In hospitals and nursing homes, it's common to encounter patients who struggle with performing everyday tasks independently. These tasks can range from taking medication to moving around the facility. Due to the diverse needs of patients and residents, staff members often find themselves juggling multiple responsibilities with varying levels of urgency. This challenge becomes more pronounced as the number of individuals requiring care increases.

Despite being well-trained, staff members simply can't be present with each individual at all times. This gap in supervision can potentially lead to delays in addressing patients' needs or emergencies.

To alleviate this burden and ensure timely assistance, a solution has been developed: a device that promptly notifies staff when a patient requires assistance. Importantly, this device is designed to be seamlessly integrated into the patient's routine without causing any inconvenience. It's user-friendly and adaptable, meaning it can cater to the diverse needs of different individuals.

The technology utilized in this device is not only efficient but also has the potential for widespread implementation. It's designed to be attractive and scalable, ensuring its viability in various healthcare settings.

One innovative feature of this device is gesture control, which is considered the future of interaction. By employing simple gestures, patients can effortlessly communicate their needs to staff members. This streamlined communication process minimizes the energy required for tasks and reduces the reliance on constant supervision, ultimately enhancing the overall efficiency of care delivery.

### Methodology

Based on our thorough investigation, we devised a plan for developing our system. Through our research, we found that while advanced technology exists in this field, it tends to come with a hefty price tag, making it inaccessible to many. Our goal is to create a system that is affordable and accessible to all. Our system is designed to be intuitive and easy to use. We've utilized familiar technologies like accelerometers and Wi-Fi modules, which are commonly found in everyday devices. Activation is as simple as pressing a button, making it user-friendly for everyone.

We've carefully selected components to ensure that our system remains cost-effective. While existing solutions may be prohibitively expensive for some, ours offers a more budget-friendly option without compromising on accuracy.

Our system is designed for easy upkeep. The commercially available components require minimal maintenance, with the exception of the 9V battery in the transmitter, which may need regular replacement.

We've prioritized the environmental impact of our system. The components we've chosen do not emit harmful radiation, and we've included clear disposal guidelines for the 9V battery to ensure proper handling.

We've considered user comfort in the design of our system. It's lightweight and easy to put on and take off, whether it's worn as a glove, wristband, or leg band.

While our system does require energy to function, it's designed to be energy-efficient due to its compact size. The transmitter operates on a 9V battery, while the receiver requires a 12V adaptor, minimizing power consumption.

### Components Required

The components required for our system are broadly divided into two categories: the transmitter and the receiver, with additional components used to interface between them.

**Atmega328P microcontroller:**

We utilize the Arduino Uno's ATmega328, preprogrammed with a bootloader, allowing easy

code uploads without the need for an external hardware programmer. This microcontroller boasts 32 Kbytes of main memory, power-saving modes ideal for mobile embedded devices, and efficient execution of programmed tasks due to its advanced RISC design. Additionally, its in-chip temperature sensor enables operation in elevated temperatures.

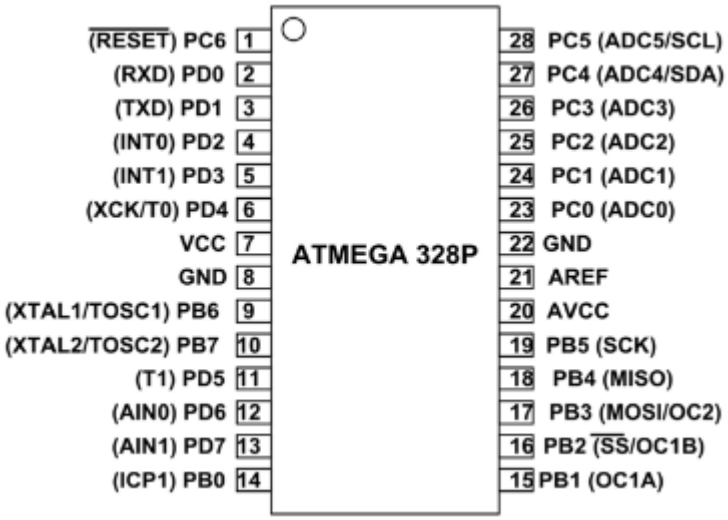


**Fig 1: Atmega 328P**

**RF Transmitter:**
This module operates on the Radio Frequency (RF) band, spanning from 30 kHz to 300 GHz. Digital information is transmitted through variations in the amplitude of the carrier wave.
Amplitude Shift Keying (ASK) serves as a modulation technique. The components exhibit the following characteristics: a transmission range of 100 meters, utilizing a frequency of 433MHz for information exchange between the transmitter and receiver, all while maintaining low power consumption.

**Receiver:**
RF Receiver: Included in our system is an RF decoder capable of decoding 12 bits of data.

To streamline installation and minimize waste, the components are automatically linked. When acquiring the system, it's important to select a pair with matching addresses and data formats. The RF decoder is essential for enabling wireless communication between the transmitter and receiver.

**Accelerometer:**
An accelerometer is a mechanical device utilized to monitor acceleration forces. These forces can be either static, such as gravity's constant pull, or dynamic, as seen in mobile devices for detecting movement or vibrations. In our system, the accelerometer plays a crucial role in recording the user's lean angle once the system is operational. It can calculate static gravity rates using tilt-sensing signals, in addition to capturing dynamic acceleration motion, shocks, or vibrations.

For user convenience, our system is designed to be as simple to use as sliding on a glove. If wearing a glove proves uncomfortable, it can alternatively be worn as a wristband. The transmitter is mounted on the top of the glove using double tape for secure placement.

The block diagram below illustrates the implementation of the smart glove and its functionalities.

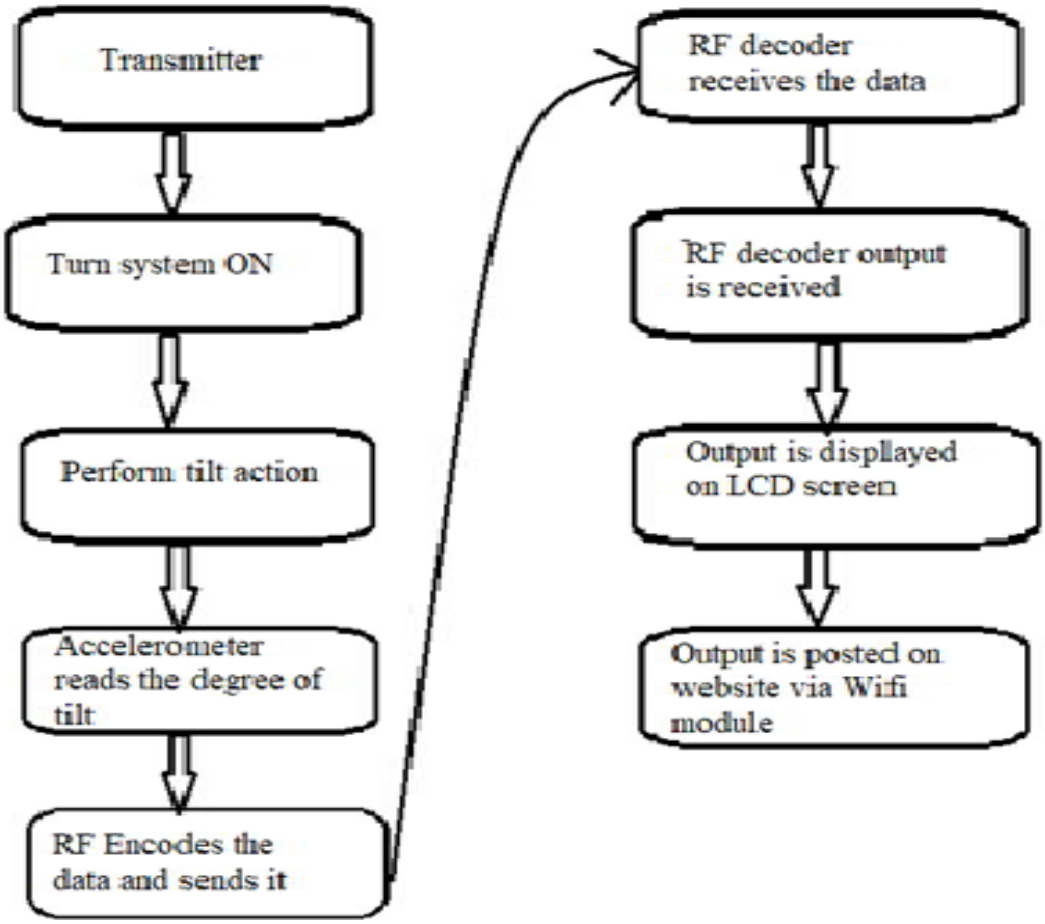


**Fig 2: Block diagram**

These health monitoring devices span a wide spectrum, ranging from basic blood pressure and heart rate monitors to advanced equipment capable of overseeing specialized implants like pacemakers, Fitbit electronic wristbands, and sophisticated hearing aids. Some hospitals have introduced "smart beds," equipped with sensors that detect patient discomfort, occupancy, and movement, enabling automatic adjustment to provide appropriate pressure and support without manual intervention from nurses. According to a 2015 analysis by Goldman Sachs, healthcare IoT devices have the potential to save the United States over $300 billion annually by increasing efficiency and reducing costs. Additionally, the utilization of mobile devices to aid in medical follow-up has given rise to 'm-health,' facilitating the analysis of health data for improved care.

**Results**

The transmitter records the tilt angle and transmits it to the receiver, powered by a 9V battery. When the switch is activated, the LED Upon system activation, the LED bulb illuminates, signaling readiness for use. As the user engages in activities, the microcontroller receives input from the accelerometer. This input includes values indicating the tilt angle along the X-axis (Left or Right) and the Y-axis (Forward or Reverse), categorized as angles exceeding -30 degrees or surpassing 30 degrees. Upon encoding, the data is transmitted through RF media, decoded by the RF decoder, and delivered to the transmitter's output pins, displaying the relevant output. Subsequently, the data is transmitted to the website via the Wi-Fi module, enabling caretakers to access it remotely from any location.

**Conclusion**

It's important to recognize the multitude of challenges faced by paralyzed patients, and in terms of patient monitoring, this device can offer significant benefits. Like any gadget, there's always room for improvement. For instance, we could expand the range of gestures or enhance the functionality of the accompanying website. While initially designed for use in hospitals or nursing homes, with some adjustments, this system could find applications beyond these settings. Moving forward, it's incumbent upon us to continuously innovate and develop new technologies to aid individuals across various contexts.

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