

IoT-Based Wheel Chair for Fall Detection and Health Monitoring

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Abstract: The IoT-based wheelchair fall detection and health care system is used to detect when a patient is fallen from the wheelchair. When a patient has fallen out of their wheelchair, the IoT-based wheelchair fall detection and health care system is utilized to determine when this has occurred. When there is a need for the patient, the accelerometer sensor is engaged by hand movement. The message is then communicated to the appropriate person via text or phone, and the need is satisfied. It is possible to automate the light and fan with your voice using voice recognition. This technology provides continuous monitoring of the patient's temperature and pulse.

Keywords: IoT, Wheel Chair, Fall Detection, Health Monitoring.

Introduction:

The planned IWC can be accessed with a touch-screen Android device through USB or Bluetooth. H-extension circuits drive engines. Implement MEMS 3-hub accelerometer fall-location framework [1]. GPS can help determine the correct seat and where the fall occurred. GPRS, a live streaming module, helps track wheelchairs. These wheelchairs are too pricey for most people. If older adults find it difficult to walk or wheel to the commode, they may do it less often or consume less fluid to reduce urine. If they can't walk or wheel themselves to the toilet and aid isn't accessible at home, assisted living may be necessary [2-5]. Mobility constraints are the major cause of functional impairments in adults, affecting 40 per 1,000 18-44-year-olds and 188 per 1,000 85-and-older adults. Seniors' health and safety must be monitored. They risk falling due to frailty and weak joints. Knowing if a senior has fallen allows for prompt assistance. Check wheelchairs for fall detection [6-11]. A sophisticated fall detection system is proposed. It can be installed on a person's hand or wheelchair to detect movement [12]. The sensor transmits acceleration data to Arduino UNO. Now, the system detects falls and sudden movements. A system jerk is a fall. If the person didn't fall and the alarm was false, the system allows snoozing in 5 seconds. Suppose someone skips sleep [13]. When the system senses a fall, it sends a Wi-Fi alarm to loved ones immediately. When a patient needs something, hand movement in front of the Accelerometer sensor sends a message to the appropriate person. An accelerometer sensor will text or phone the patient's wheelchair needs. Voice-recognition controls light and fan. This system monitors patient temperature and pulse [14-17].

Block Diagram Description

This smart wheelchair uses an AVR ATmega328 microcontroller. The smart system's controller controls all modules [18]. ATmega328 is an Atmel 8-bit Advanced RISC microprocessor (figure 1).

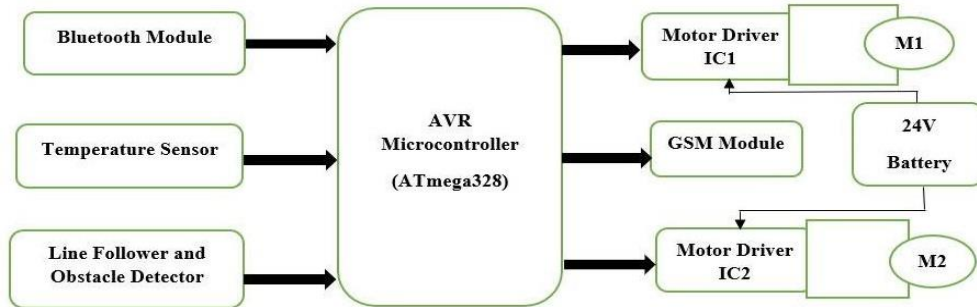


Figure 1: Block Diagram

Proposed System

This approach helps physically challenged people and caregivers communicate. The device detects falls and alerts authorities. Patient monitoring isn't necessary. SMS and Call help patients. It assists in medical emergencies [19-21].

Working Principle

The system can be installed on a person's hand or wheelchair to detect movement. Health monitoring and wheelchair fall detection. Call and SMS send patient needs [22-24]. This system shortens patient monitoring.

ARDUINO UNO

Arduino is a user-friendly open-source electronics platform. Arduino boards can turn inputs (light on a sensor, a finger on a button, a Twitter message) into outputs (starting a motor, turning on an LED, publishing online) [25-29]. The board's microcontroller can be told what to do. Arduino and Arduino Software (IDE) are utilised (figure 2).

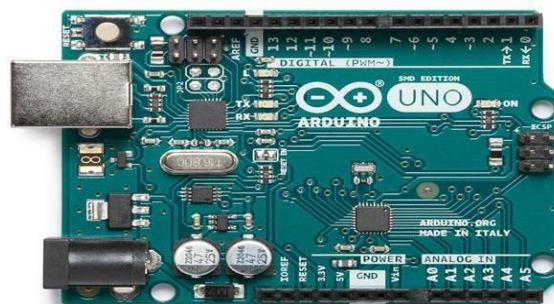


Figure 2: Arduino UNO

Arduino has powered countless of projects, from common objects to scientific apparatus. Arduino was created at the Ivrea Interaction Design Institute as a quick prototyping tool for non-technical students [30-35]. As soon as Arduino reached a wider audience, it changed to adapt to new requirements and difficulties, offering devices for IoT, wearable, 3D printing, and embedded contexts [36-41].

Pin diagram

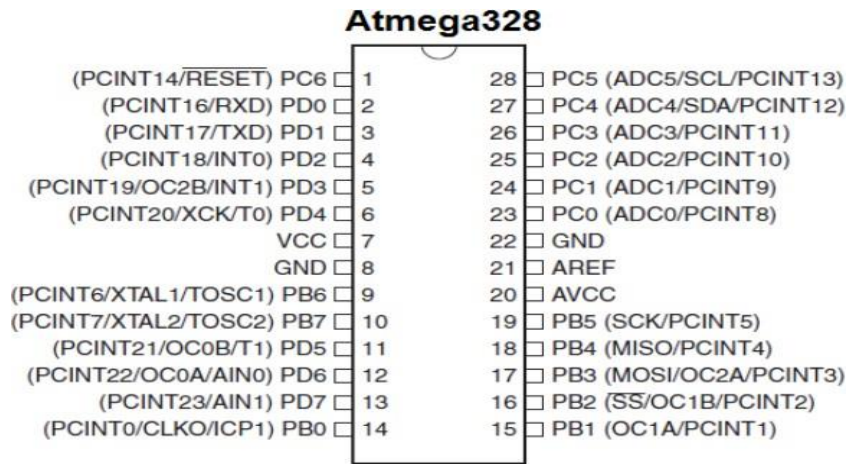


Figure 3: Pin Diagram

Architecture Design

ATmega 328P is a low-power CMOS 8-bit RISC microcontroller. The ATmega48P/88P/168P/328P delivers throughputs of 1 MIPS per MHz by executing strong instructions in a single clock cycle, allowing system designers to minimise power consumption versus processing performance (figure 4) [42-47].

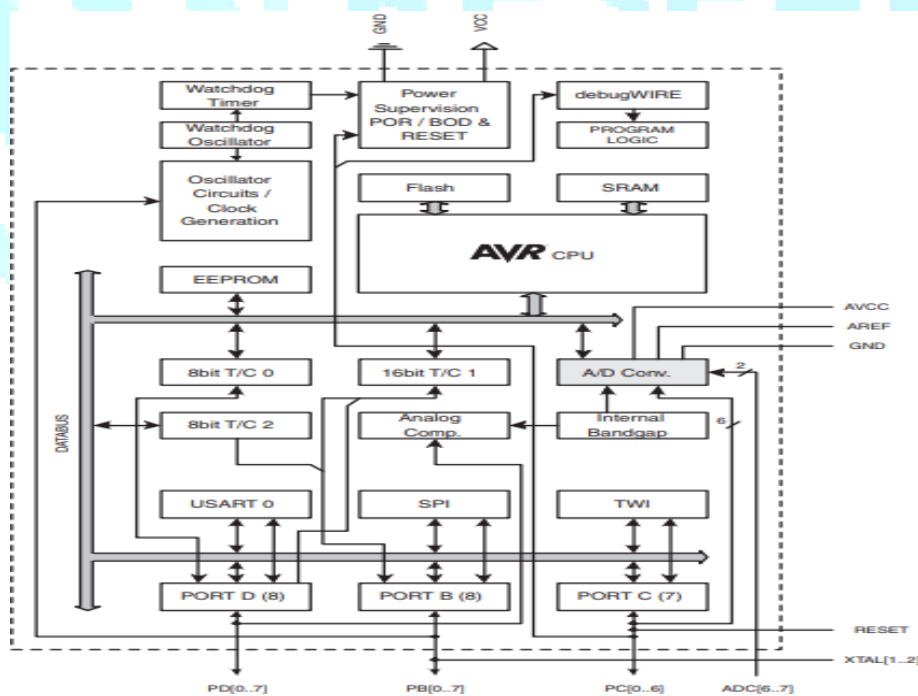


Figure 4: Architecture Design of AVR MCU - AT328P

AVR core has 32 general-purpose working registers and a comprehensive instruction set. All 32 registers are directly coupled to the ALU, allowing two independent registers to be accessed in one instruction [48-51]. The status register is updated after each arithmetic operation (figure 5).

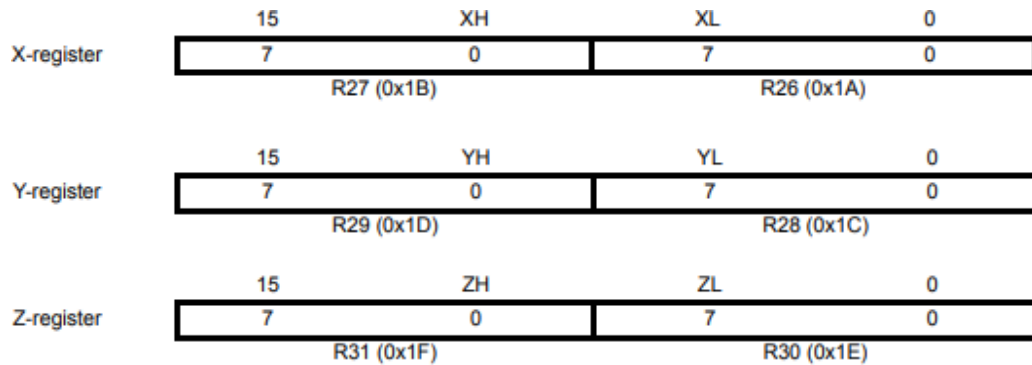


Figure 5: Arithmetic operation

This can be provided via VIN, USB, or another regulated 5V source. Onboard regulator produces 3.3 V. 50 mA is max current. GND Electrodes [52-67]. Sleep modes allow applications to power down unneeded MCU modules. The AVR's sleep modes let you adapt power consumption to your application [68-71]. When activated, BOD checks power supply voltage during sleep times (figure 6).

Circuit Diagram

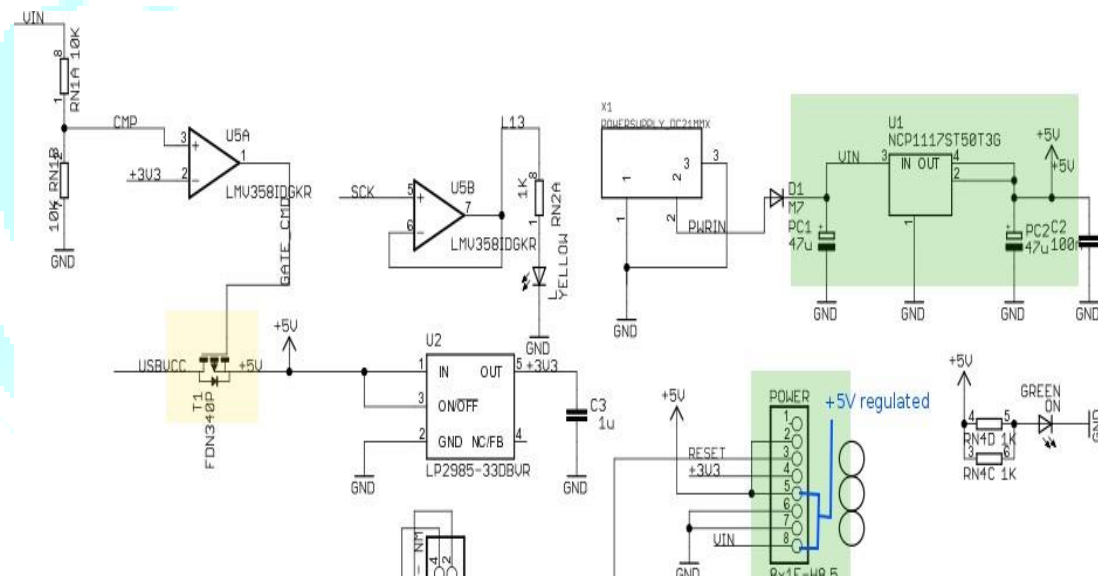


Figure 6: Circuit Diagram of Power Supply Design – Arduino UNO

General-Purpose Input And Output

By default, they measure from ground to 5 volts, although the AREF pin and analogue Reference() function can adjust this. Some pins are multipurpose. I2C4&5 (SCL). Wire library supports I2C (TWI) [80-85]. AREF. Analog input reference voltage. analogReference-compatible (). RESET This line resets the microcontroller. Shields that obstruct the board's reset button usually have one [86-91]. See Arduino pin-to-ATMega328 port mapping (figure 7).

Layout Connection of Arduino Uno

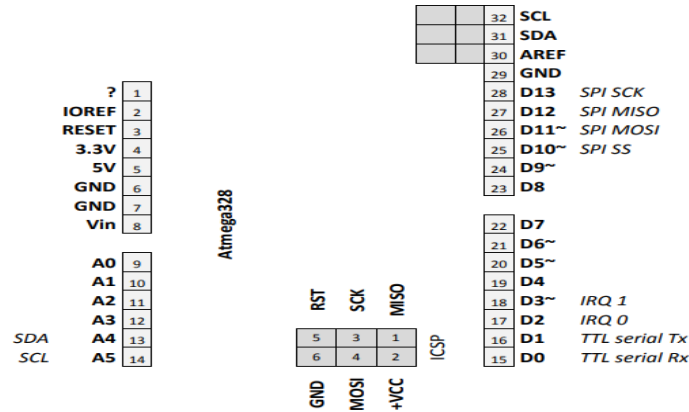


Figure 7: Layout diagram of Arduino

Benefits of Arduino

Arduino boards are cheaper than competing microcontrollers. Arduino operates on Windows, Mac OSX, and Linux [92-111]. Windows dominates microcontrollers. Arduino's programming environment is easy for beginners and adaptable for experts. Arduino software is open source and expandable by knowledgeable programmers. Arduino uses Atmel's ATMEGA8 and ATMEGA168 microcontrollers [112-117].

Arduino Ide

Integrated Development Environment (IDE) combines editor, linker, and compiler to let developers produce Firmware for Innovative Projects. Arduino IDE is used for quick prototyping and library access on the open-source platform [118-125]. This beginner-friendly tool supports embedded C, Luna, etc. Arduino has powered countless of projects, from common objects to scientific apparatus [126-135]. Arduino Uno, Nano, Mega, etc. are supported. As soon as Arduino reached a wider audience, it changed to adapt to new requirements and difficulties, offering devices for IoT, wearable, 3D printing, and embedded contexts [136-145].

Power Supply

One circuit can provide 12V and 5V DC power. Two ICs, 7812 and 7805, provide the necessary voltages. The transformer steps down the AC mains voltage, which is rectified by a bridge and filtered by a capacitor [146-156]. The 7812 regulates it to 12V DC. 7805 regulates IC1's output to 5V DC. This produces 12V and 5V DC (figure 8).

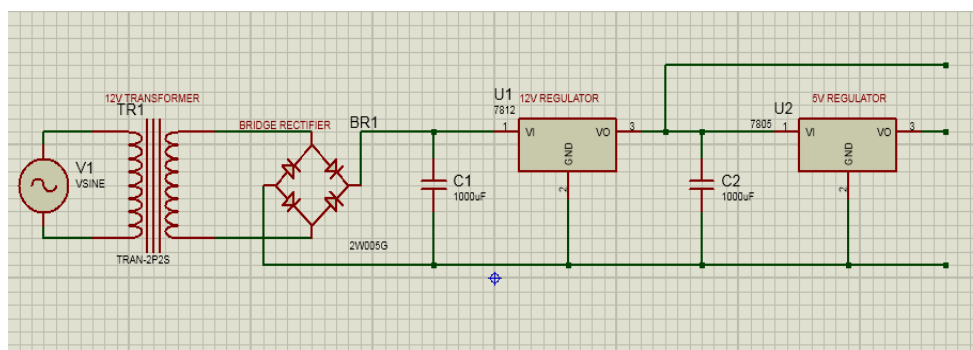


Figure 8: Circuit diagram

Small stepdown transformer reduces 230V AC to 12V AC. A rectifier converts the transformer's sinusoidal AC output to DC. An output filter circuit eliminates AC ripples and passes DC components. 12V DC is converted via 7812 regulator. And 7805 converts 5V DC [157-168].

Accelerometer

The sensor requires 2.2 to 3.6VDC (3.3V optimum) and 400A. All three axes output analogue (figure 9).

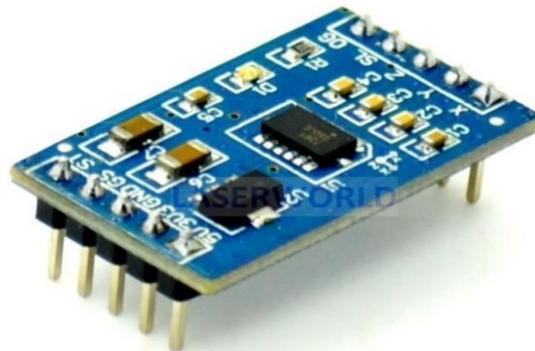


Figure 9: Accelerometer Sensor

Purpose of Accelerometer

Accelerometers have scholarly and consumer uses. Laptop accelerometers safeguard hard drives. The laptop's accelerometer would detect a quick drop and turn off the hard disc to protect the reading heads [169-175]. Without this, the two would collide and inflict file and reading harm. Accelerometers in cars detect impacts and activate airbags almost instantly. A dynamic accelerometer measures gravitational attraction to determine device tilt. Users examine device movement by measuring acceleration. Accelerometers help users understand a product's surroundings [176-181]. This little device can tell if an object is travelling uphill, tilting too far, flying horizontally, or angling downward. Smartphones switch between portrait and landscape mode when tilted [182].

How They Work

An accelerator resembles a simple electronic circuit [183]. The accelerometer has numerous pieces and works in many ways, including piezoelectricity and capacitance. Piezoelectric accelerometers utilise small crystal formations strained by acceleration. Accelerometers have multiple axes, two for 2D movement and a third for 3D placement. Smartphones employ three-axis models to determine impact, while autos use two. These gadgets are sensitive enough to measure minute acceleration changes. More sensitive accelerometers measure acceleration better. Accelerometers are used in many electronics and can be customised. The accelerometer is important for engineers and tech geeks alike. You may not notice this simple sensor, yet you're probably using a device with it [184-191].

Vibration Sensor

This module has an adjustable potentiometer, a vibration sensor, and an LM393 comparator chip to give a digital output based on vibration [192-199]. The potentiometer adjusts sensitivity. When activated, the module outputs VCC and GND. When activated, an inbuilt LED illuminates (figure 10).

**Figure 10: Vibration Sensor**

Working

Motion sensor module SW-420, SW-420 is a normally-closed vibration sensor. Clean comparator output, nice waveform, and 15ma+ driving ability. 3.3V-to-5V operating voltage. Switch output (0 and 1) Easy installation, fixed bolt hole 3.2cm x1.4cm PCB. Wide voltage comparator LM393 No vibration, vibration switch is on, output terminal is low, green light is on. Vibration switch immediate disconnection, High power, green light is dim Output can be directly connected to the microcontroller through a single-chip microcomputer to identify high and low levels, allowing police to detect a vibration environment. Used to trigger vibration, theft alarm, smart car, earthquake alarm, motorcycle alarm, etc. This module is similar to typically open vibration sensor modules; longer vibration triggers can operate relay modules.

LM35 Temperature Sensor

LM35-series devices are offered in hermetic TO transistor packages and plastic TO-92 transistor packaging. LM35D comes in 8-lead surface-mount small-outline and plastic-220 packages (figure 11).

**Figure 11: LM35 Temperature Sensor**

How To Use LM35 Temperature Sensor

LM35 is a precision IC temperature sensor whose output voltage fluctuates with temperature. This inexpensive IC can measure temperatures from -55°C to 150°C . It can be interfaced with any ADC-capable microcontroller or Arduino. Connect the input pin to +5V (VS) and the ground pin to the circuit ground. As illustrated here, you may measure temperature as voltage (figure 12).

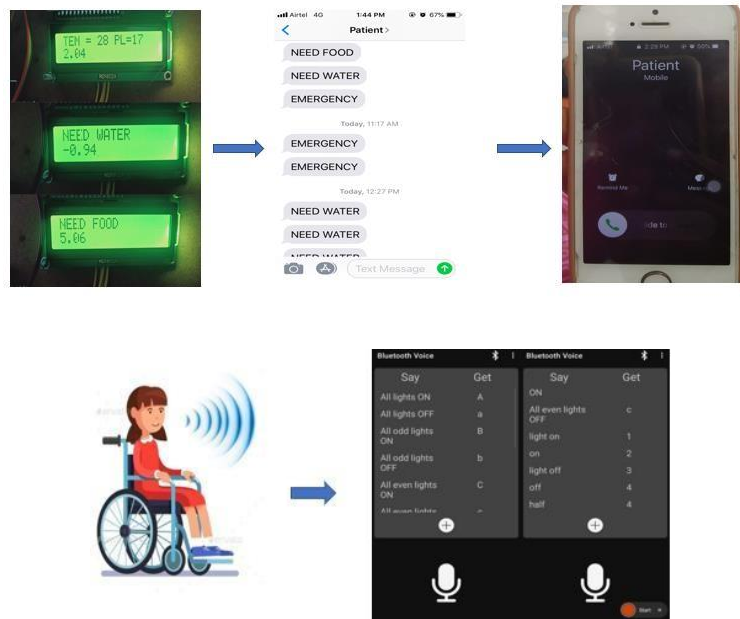


Figure 14: Output Image

Conclusion

This system helps the communication between the physically challenged and also the caretaker. The device can detect falls and direct much-needed attention to the person. There is no need for continuous monitoring of the patient. The need of the patient is filled by SMS and Call. It also helps when a medical emergency is needed for the patient. Wheel Chair Has A Wide Range of Applications and Scope in the Following Areas: Physically Challenged People, Patients in The Hospitals, and Old Age Homes. This system can be further developed into an intelligent system that works on machine intelligence to help report various medical conditions with the help of other sensors.

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