Intelligent Wheel Chair for Physically Challenged People using IoT

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Abstract:- A large portion of the world population has a physical disability, a large portion of them need a wheelchair for easy movement. Aged citizens and temporarily disabled persons due to accidents or illnesses or blind people also need a wheelchair permanently. Automatic fall detection is a major issue in taking care of the health of elder people and has the potential of increasing autonomy and independence while minimizing the risks of living alone. It has been an active research area due to the large demand of the healthcare association for fall detection goods. A conventional wheelchair needs some assistance from other people or some physical effort of the patient. Owing to the recent rapid advancement in sensing and wireless communication technologies, patient support and monitoring system are getting more user friendly and easier to use. In this project, a prototype of a wheelchair along with a fall detection system is developed using IoT. This prototype may be helpful to monitor when a person accidentally falls from the wheelchair. In addition, this project also includes obstacle detection system and health monitoring system. The instrumented wearable device enables the analysis of the subject's motion and foot orientation, recognizing abnormal configurations. The developed algorithm [is not computationally intensive, and therefore, can be easily executed on board the wearable device.

INTRODUCTION

One of the leading health problems in elderly is caused by falls. These falls, more often than not, have devastating consequences. While, full-time care is generally provided to fall-prone patients, it is not possible to anticipate and prevent falls all the time. Falls in older persons are caused by underlying health impairments. They can be caused by some neuromuscular and sensory dis-functioning or also could be associated with fatigue, arthritis, dementia, diabetes, nutrition deficiency, anaemia, Arrhythmia, vision impairment, hearing impairment, disturbed (higher or lower) body mass index, urinary issues, insomnia, cardiovascular diseases etc. Some environmental factors like footwear, ill lighting, slippery floors etc. can also cause falls and thus slipping, tripping and stumbling are reported as the primary mechanism of falling. Various medications are also reported to increase the risk of falls in people above 70 years of age. These medications include but are not limited to, sedatives, hypnotics, antidepressants, diuretics, nonsteroidal anti-inflammatory drugs and antihypertensive etc. Medical personnel generally use Morse Fall Scale (MFS) to tabulate risk factors and diagnoses.

a. Physical consequences of falling are those consequences that are medical or health related in nature. These include- open fractures. lacerations, bruises, closed fractures, extravasations of blood, sprain, and internal bleeding including brain bleed, bleeding into peritoneal cavity, mesentery cavity and momentum etc. These consequences often cause decline in overall functioning of the person. More frail people are often vulnerable to these kinds of injuries.

b. Psychological consequences describes about the falls generally results into loss of confidence in doing trivial activities like walking etc. The increased dependence on family often increases social anxiety and further depletes confidence. A sense of fear is developed in most of the people and they are not able to do day-to-day tasks by themselves. It further increases irritability and mental stress. Often, these falls also cause mental trauma on the patient and they get reminded of the injury repeatedly. (1-6)

c. Problem definition says that the above data states that there is an urgent need for an automated device for the detection of the falls. People are generally found unconscious over the scene. Due to loss of consciousness, they are themselves not able to call for help. The delayed medical help can cause rapid and uncontrollable internal bleeding or other such issues and thus increases the mortality rates after falls.

SYSTEM ARCHITECTURE

This research work is very helpful for critical patients like coma patients, dialysis patients and for those who were on bed for a long period. Because in these conditions, a minor movement done by the patient is detected that plays an important role in their treatment.In older systems there are no techniques to detect the patient's movement and it is very hard to monitor them by using manual power only. Now using sensors, patient's movement can be easily monitored.

Conventional system has developed a wearable inertial sensor for human motion analysis to continuous track motions and positions of aging people. This system is comprised inertial measuring unit such as MEMS sensor for motion tracking. Also, for monitoring the health condition of elderly people and reports are transmitted by RF to the doctor. This system consists of heart rate sensor, pulse sensor, ECG sensor and Muscle sensor and a local

monitoring RF transmitter and receiver. (6-10)

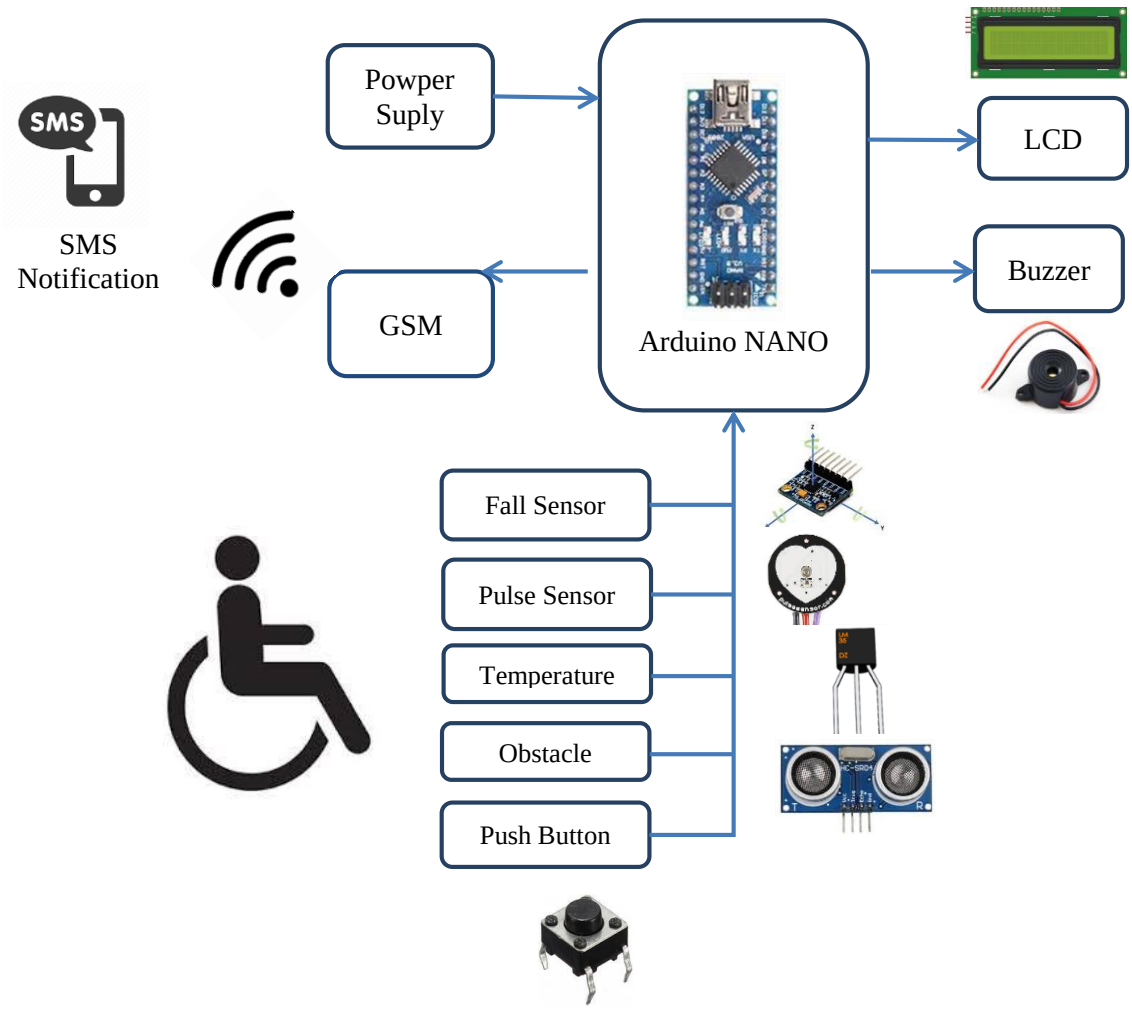
- Low monitor precision
- Difficulty in monitoring patient
- Connection of many instruments are tedious process
- Difficulty in monitoring patient body temperature by thermometer
- Heart beat is measured manually

PROPOSED SYSTEM

Firstly, the proposed method is tested to select the discriminative parameters on synthetic data and evaluate its efficiency compared to well-known methods in literature. After that, proposed system will show the results of parameters' extraction and selection, and then the change detection on real data. Note, that the accelerometer is used to enforce the differentiation between the falling and the lying down posture.

- The Low power assist device is a part of an indoor fall detection monitoring system and assist device designed for elderly people living alone. The implemented network characterized by patient's indoor location, fall alert, temperature and heart rate measurement capability through the usage of patients and remote monitoring.
- For each sensor the sampling rate associated with analog channel is programmed in order to assure good accuracy of health parameter calculation, also the guidelines of health monitoring index which defines the minimum number of samples needed to an efficient calculation. The remote service center receives the message; a medical monitoring group can contact the user, and then decide whether to send assistance.
- The remote monitoring center to send technicians to replace the battery when it runs low and the user can know the battery status of the LP assist device. In this project, it includes device and hardware part comprise of GSM/GPS module, LCD (16*2), Controller and different type of required sensor. Software is used to interface the elements with each other. The main motive of the project is to provide a protective ride and also to decrease the death rate. The arithmetic circuits also act as a major role in GSM/GPS module. (11-13)

BLOCK DIAGRAM

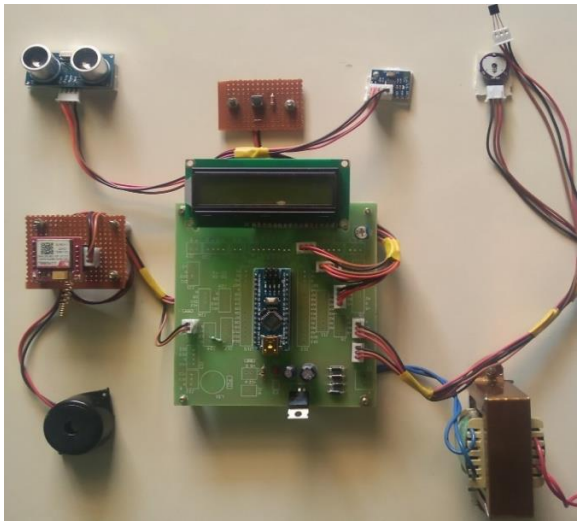


DESCRIPTION

The implemented system characterized by patients' location, fall alert, temperature and heart rate measurement through the usage of patients and remote monitoring. For each sensor the sampling rate associated with analog channel is programmed in order to assure good accuracy of health parameter calculation. The remote service center eceives the message, a medical monitoring group can contact the user, and then decide whether to send assistance.

Module Split-up

- **MODULE 1 -** Fall Detection
- **MODULE 2 -** Obstacle Detection
- **MODULE 3 -** Health Monitoring



RESULT

Proposed Fall detection methods includes vision-based, acoustic-based, passive infrared sensor-based, and inertial sensor-based methods. Provided information for reasoning about the observed space were later on integrated into smart environments, aimed at delivering assistance services like continuous diagnosis of users' health. A method to assess foot placement during walking using an ambulatory measurement system consisting of orthopedic sandals equipped with force/moment sensors and inertial sensors.

FUTURE ENHANCEMENT

- ✓ In future, the project will be imparted with the air bag concept of car (which is available in the car to prevent the injuries during accidents) while a person falls from the wheel chair.
- ✓ Also, the project could be updated with automatic stop control when the obstacle is detected which may be highly helpful to the physically challenged like blind people to move around without any guidance.

CONCLUSION

The device can detect falls and direct much needed attention to the person. However, the device has to be further modulated and changed according to personal requirements. Using, machine learning algorithm instead of threshold algorithm may make the device more accurate and robust. Furthermore, the device also needs to take into account other factors like different medical conditions of the person. The situation has attracted a lot of researchers and various researches are going on to determine a perfect way to detect and prevent falls. Using sensors mentioned in the paper is an approach that can be further enhanced to enhance the overall working of the system.

REFERENCES

[1] Adam A,Mokhtar N, Mubin M, Ibrahim Z, Tumari MZ, Shapiai MI (2014), 'Feature selection and classifier parameter estimation for EEG signal peak detection using gravitational search algorithm', 4th International Conference on Artificial Intelligence with Applications in Engineering and Technology, (pp. 103-108).

[2] Akash Gupta, Rohini Srivastava, Himanshu Gupta and Basant Kumar (2020), 'IoT Based Fall Detection Monitoring and Alarm System For Elderly', on IEEE 7th Uttar Pradesh Section International Conference on Electrical, Electronics and Computer Engineering (UPCON).

[3] Alshurafa N, Eastwood JA, Nyamathi S, Liu JJ, Xu W, Ghasemzadeh H, Pourhomayoun M, Sarrafzadeh M (2014), 'Improving compliance in remote healthcare systems through smartphone battery optimization', IEEE Journal of Biomedical and Health Informatics, 19(1):57-63.

[4] Amberlay Ruíz-Serrano; Miriam C. Reyes-Fernández; Rubén Posada-Gómez; Albino Martínez-Sibaja; Alberto A. Aguilar-Lasserre (2014), 'Obstacle avoidance embedded system for a smart wheelchair with a multimodal navigation interface', on 11th International Conference on Electrical Engineering, Computing Science and Automatic Control (CCE).

[5] Bianchi F, Redmond SJ, Narayanan MR, Cerutti S, Lovell NH (2010), 'Barometric pressure and triaxial accelerometry-based falls event detection', IEEE Transactions on Neural Systems and Rehabilitation Engineering, 18(6):619-27.

[6] Changhong Wang, Michael R Narayanan, Stephen R Lord, Stephen J Redmond, Nigel H Lovell (2014), 'A low-power fall detection algorithm based on triaxial acceleration and barometric pressure', Annu Int Conf IEEE Eng Med Biol Soc, doi: 10.1109/EMBC.2014.6943655.

[7] Devansh Kumar Garg and Gauri Rao (2020), 'An IoT Based Fall Detection System', on International Journal of Innovative Technology and Exploring Engineering (IJITEE), ISSN: 2278-3075, Volume-9 Issue-6.

[8] Dr. Emna Baklouti, Prof. Nader Ben Amor & Prof. Mohammed Jallouli (2016), 'Autonomous wheelchair navigation with real time obstacle detection using 3D sensor', on Journal for Control, Measurement, Electronics, Computing and Communications.

[9] Fabio Bagalà, Clemens Becker, Angelo Cappello, Lorenzo Chiari, Kamiar Aminian, Jeffrey M Hausdorff, Wiebren Zijlstra, Jochen Klenk (2012), 'Evaluation of accelerometer-based fall detection algorithms on real-world falls', 7(5):e37062. doi:10.1371/journal.pone.0037062.

[10] Malek Njah and Mohamed Jallouli (2013), 'Wheelchair obstacle avoidance based on fuzzy controller and ultrasonic sensors', on International Conference on Computer Applications Technology (ICCAT).

[11] P. Anguraj and T. Krishnan, "Design and implementation of modified BCD digit multiplier for digit-by-digit decimal multiplier," Analog Integr. Circuits Signal Process., pp. 1–12, 2021.

[12] T. Krishnan, S. Saravanan, A. S. Pillai, and P. Anguraj, "Design of high-speed RCA based 2-D bypassing multiplier for fir filter," Mater. Today Proc., Jul. 2020, doi: 10.1016/j.matpr.2020.05.803.

[13] T. Krishnan, S. Saravanan, P. Anguraj, and A. S. Pillai, "Design and implementation of area efficient EAIC modulo adder," Mater. Today Proc., vol. 33, pp. 3751–3756, 2020.