Iot Based Walking Stick With Gps Navigator And Emergency Alert System

Shaik Ahmadsaidulu, KTPS Kumar, G Anish Kumar, SushmaYarlagadda, Anvesh Lanka, Gopi P Kalyan Komma

Abstract: Visually impaired people and elders face difficulties in abstaining from obstacles and discerning hazards because of the inadequacy of information for staying out of harm's way in their everyday routine. They have insufficient knowledge about some of the things like self- velocity, the velocity of moving objects, proximity of living beings, dangerous gases and so on. Therefore, we contemplate developing an electronic system that inherently contains various modules for various functions like obstacle detection module, a fall detection module, navigation module and also Alert system. This design is developed using NI myRIO, which will be mounted on a walking stick that abets the holder to be connected with his/her family. While the obstacle detection module employs a set of ultrasound sensors, PIR sensor, and an alarm system to guide the carrier, the fall detection is primarily achieved by a 3-axis accelerometer which is an inbuilt function in myRIO. The hazard detection module is used to detect the harmful gases and fire in both indoor as well as outdoor environments and alerts the user. The user can intimate to his/her family member in hazard situations using the SOS button. The navigation module can send the GPS location of the carrier which is acquired from this module and send it to a particular mobile number or mail.

Keywords: Accelerometer, Global Positioning System,Internet of Things, National Instruments (NI) -myRIO

1. INTRODUCTION

Individuals associate with the encompassing condition with the assistance of sensory organs. The human cerebrum joins the structures of neurons of eyes, ears, nose, tongue, skin into a significant entirety. About 80% of the data that we could get a handle on or translate from the earth is nonverbal, the eyes best shield us from risk. What might occur in the event that you lose your visual perception!! Vision being the most imperative feeling of all, the rest of the faculties like touch, taste, and smell are straightforwardly or in a roundabout way reliant on it. A case of it is that eyes in relationship with the mind, unravel the shading consequently assessing the temperature of an article, even before it has been contacted. So outwardly weakened individuals and now and again, more established individuals as the vision takes a downturn with expanding age, can't keep away from a portion of the dangers that we go over in this eccentric condition that encompasses us, routinely they utilize a stick to direct over their way or take the guide of pet creatures. The Internet of Things is an emerging topic of technical, social, and economic significance it extends internet connectivity beyond traditional devices like desktop and laptop computers, smartphones and tablets to a diverse range of devices and everyday things that utilize embedded technology to generate, communicate, consume and interact with the external environment with minimal human intervention.Consumer products, durable goods, cars and trucks, industrial and utility components, sensors, and other everyday objects are being combined with Internet connectivity and powerful data analytic capabilities that promise to transform the way we work, live, and play. The concept of combining computers, sensors, and networks to monitor and control devices has existed for decades. Projections for the impact of IoT on the Internet and economy are impressive, with some anticipating as many as 100 billion connected IoT devices and a global economic impact of more than $11 trillion by 2025. Several policies and guidelines have been developed for deploying IoT technology in the healthcare field. The IoT remains largely underutilized in the medical field [1], and a thorough understanding of current research on the IoT in the healthcare context is of fundamental importance. For making their day-to-day deeds easy and keeping them out of sight from danger in both indoor and outdoor environments, we intend to make this stick into a smart device [2] which can detect dangers and alert them so that they could avoid those threats. This smart stick [4] is assembled with the ultrasonic sensor, PIR sensor, flame sensor, gas sensor and 3-axis accelerometer inbuilt in NI-myRIO; all of these components can detect the dangers and alert the user regarding the same. Both ultrasonic sensor and PIR sensor contribute for obstacle detection, while the ultrasonic sensor can sense non-living and stationary objects, PIR sensor can detect living beings or more specifically warm bodies. The flame sensor is used to detect very high temperatures in case there is the presence of fire in the path and alerts the user. The 3-axis accelerometer can be used for fall detection[5] because sometimes these prove to be inevitable and fatal. All these sensors form various modules, each module has different functionality.

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I. PROPOSED SYSTEM

The proposed prototype as shown in Fig.1 is an electronic device that constitutes of obstacle detection module, a fall detection module, hazard detection module, navigation module combined with GPS and IOT, alert system along with distress button and the main processor used here is powered by an external battery which is National Instruments myRIO. This myRIO is the hardware which can execute the instructions that we design in the LabVIEW which is the software which acts as the interface between hardware components and myRIO. All the mentioned components are combined and mounted on to a walking stick.

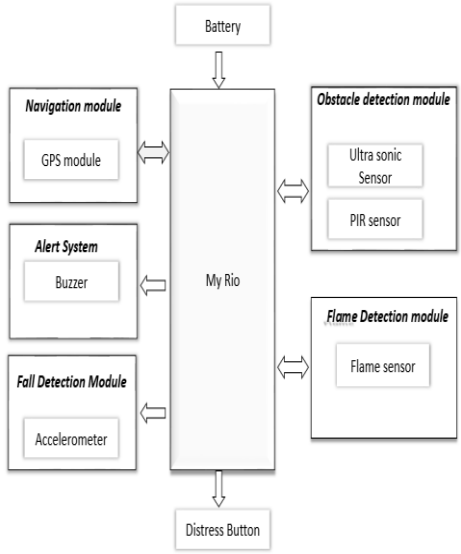

Figure 1. *Proposed System*

The project also incorporates IoT technology to interconnect the fall detection, obstacle detection, and hazard detection modules with the internet and thus report any instances of a fall and/or abnormal conditions which the holder may have to face to the family member(s) of the vulnerable person via E-mail through LabVIEW software. A special distress button will be used by the vulnerable person in a situation where they come face to face with dangers unexpectedly, to connect with the family immediately.

A. Obstacle-Detection-Module:

The operation of this module is to detect the presence of any obstacles[6] in the walking path of the holder, these obstacles may be stationary objects or living beings. This Module consists of two sensors (i) ultrasonic sensor (ii) PIR sensor.

(i)Ultrasonic transmitter releases a ultrasonic wave in a direction, and it starts the timer immediately when the wave is launched, this wave travels in the air, and the wave returns promptly when it adheres with any obstacles on its itinerary. The ultrasonic receiver would stop the timer swiftly after the reflected wave returns from its journey. As Ultrasonic spread velocity is 340m/s in the air, based on the timer record t, we can calculate the distance (s) between the obstacle in the path and transmitter, namely:

$$s = 340t/ 2$$

Which is also called as the time difference distance measurement principle, measure the time from launch to reflection when it encountered the obstacle, and then calculate the distance between the transmitter and the obstacle according to the time and the velocity. Distance Measurement formula is expressed as

$$L= C*T$$

In the formula, L is the measured distance, and C is the ultrasonic spreading velocity in the air also T represents time (T is half the time value from transmitting to receiving)[7].

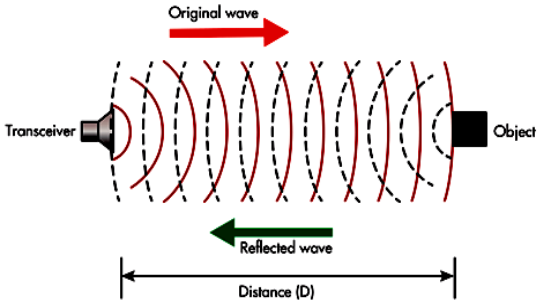

Figure 2*.Working of ultrasonic sensor (courtesy: electrodesign.com)*

(ii) A PIR sensor detects the infrared light radiated by a warm object, which can detect levels of infrared radiation. These use light sensors to detect either the presence of infrared light emitted from a warm object or absence of infrared light when an object interrupts a beam emitted by another part of the device. It consists of pyroelectric sensors which transduce changes in their temperature (due to incident infrared radiation) into the electric signal. When infrared light strikes a crystal, it generates an electrical charge.

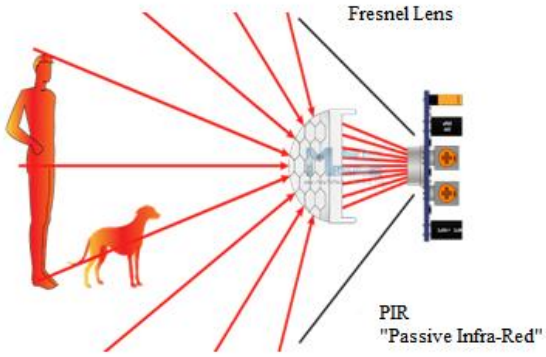

Figure 3*.Working of PIR sensor (courtesy: howtomechatronics.com)*

B. Fall Detection Module:

For a human, encountering an unforeseen fall can without a doubt be pernicious. The conspicuous probability of introductory damage might be additionally disturbed by the conceivable outcomes if treatment isn't acquired inside a brief timeframe. For instance, numerous older people can endure coincidental falls because of shortcoming or wooziness—or, when all is said in done, their decreased self-care and self-defensive capacity. Since they will in general be delicate, these mishaps may potentially have genuine consequences if aid is not given in time. Statistics show that the majority of serious consequences are not the direct result of falling, but rather are due to a delay in assistance and treatment. Post-fall consequences can be greatly reduced if relief personnel can be alerted in time. Other than senior residents, there are numerous different conditions and exercises for which a quick aware of a conceivable fall, particularly from a significant tallness, would be very useful—for instance, mountain dwellers, development laborers, window washers, painters,

and roofers. In light of this need to caution of falls, the advancement of gadgets for discovery and expectation of a wide range of falls has turned into a hotly debated issue. As of late, innovative advances in framework (MEMS) quickening sensors have made it conceivable to configuration fall identifiers dependent on a 3-hub coordinated accelerometer. The method depends on the standard of recognizing changes in movement and body position of an individual, wearing a sensor, by following quickening changes in three symmetrical ways. The information is ceaselessly investigated algorithmically to decide if the person's body is falling or not. On the off chance that an individual falls, the gadget can utilize GPS and a remote transmitter to decide the area and issue an alarm so as to get help. The center component of fall location is a viable, solid discovery standard and calculation to pass judgment on the presence of a crisis fall circumstance it is an inbuilt capacity in NI myRIO

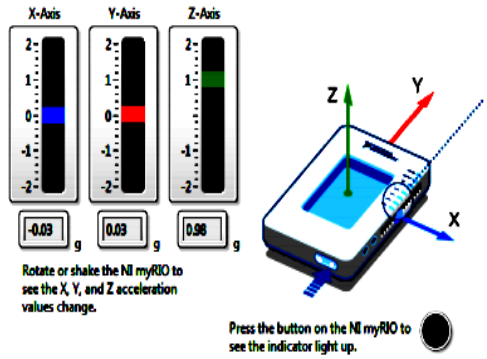

Figure 4*.Working of 3-axis accelerometer inbuilt in NI-myRIO (courtesy:ni.com)*

C. Flame detection module:

This module contains a flame sensor. It can detect infrared light with a wavelength ranging from 700nm to 1000nm. The far-infrared flame probe converts the strength changes of the external infrared light into current changes. It is sensitive to not only flame but also radiation. It has a detection angle of 60 degrees. It's working voltage is in between 3.3V to 5V.

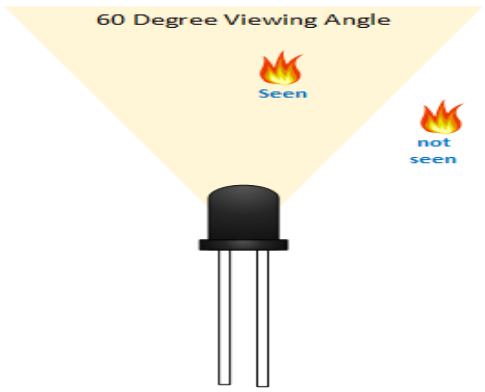

Figure.5*. Working of flame sensor (courtesy: create.aurduino.cc.com)*

D. Navigation Module:

GPS receivers use a constellation of satellites and ground stations to compute position and time almost anywhere on earth. At any given time, there are at least 24 active satellites orbiting over 12,000 miles above the earth. The positions of the satellites are constructed in a way that the sky above your location will always contain at most 12 satellites. The primary purpose of the 12 visible satellites is to transmit information back to earth over radio frequency (ranging from 1.1 to 1.5 GHz). With this information and some math, a ground-based receiver or GPS module can calculate its position and time. The data sent down to earth from each satellite contains a few different pieces of information that allow your GPS receiver to accurately calculate its position and time. An important piece of equipment on each GPS satellite is an extremely accurate atomic clock. The time on the atomic clock is sent down to earth along with the satellite's orbital position and arrival times at different points in the sky. In other words, the GPS module [9] receives a timestamp from each of the visible satellites, along with data on where in the sky each one is located (among other pieces of data). From this information, the GPS receiver now knows the distance to each satellite in view. If the GPS receiver's antenna can see at least 4 satellites, it can accurately calculate its position and time. This is also called a lock or a fix.

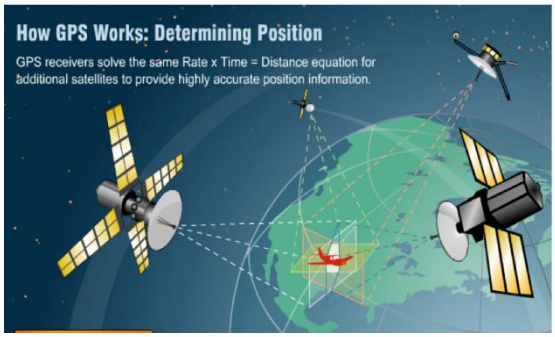

Figure 6*.Working of GPS module (courtesy: slideshare.com)*

D. NI-myRIO:

The NI myRIO [10] is an embedded design device which was created for students to "do real-world engineering". It features a 667 MHz dual-core ARM Cortex-A9 programmable processor and a customizable Xilinx field programmable gate array (FPGA) that can be used to start developing systems and solve complicated design problems faster. The NI myRIO device features the Zynq-7010 All Programmable system on a chip (SoC) to unleash the power of NI LabVIEW system design software both in a real-time (RT) application and on the FPGA level. Rather than spending copious amounts of time debugging code syntax or developing user interfaces, students can use the LabVIEW graphical programming paradigm to focus on constructing their systems and solving their design problems without the added pressure of a burdensome tool.
NI myRIO is a reconfigurable and reusable tool. The RT and FPGA capabilities along with onboard memory and built-in Wi-Fi allow students to deploy applications remotely and run them "heedlessly" (without a remote computer connection).

Figure 7*.NI-myRIO (courtesy: ni.com)*

II. METHODOLOGY

A. Obstacle Detection:

- Both the ultrasonic and PIR sensors are in standby mode.
- Sensors are in active mode.
- If any immovable object is present within the range of half meter, then the ultrasonic sensor detects it and sends this to the RIO, which then instructs the buzzer to warn the user.
- If any living being is found in the range of three to seven meters (adjustable) and in 120 degrees angle then it detects their heat signatures and transmits the same information to RIO, which instructs the buzzer to warn the user.

B. Fall Detection :

- The inbuilt accelerometer starts its operation.
- If the orientation of the accelerometer changes more than the threshold value, then it assumed to a result of a fall.
- The selected list of contacts of the user are alerted regarding the fall through the mail.

C. Flame Detection:

- Flame sensor is made active high.
- If there is presence of fire with in the range of 100 cm then it detects the harm and alerts the user regarding the same using the buzzer.

D. Hardware Requirements and Inter-Networking:

The apparatus which we have picked is NI myRIO, which have three ports in particular A, B and C which can send and get signals from sensors and hardware required. Forty advanced I/O lines generally speaking with help for different conventions like SPI, PWM out, quadrature encoder input, UART(Tx and Rx), and I2C for simpler correspondence with sensors; eight single-finished simple information sources; two differential simple data sources; four single-finished simple yields; and two ground-referenced simple yields take into consideration availability to endless sensors and gadgets and automatic control of frameworks. The majority of this usefulness is implicit and preconfigured in the default FPGA usefulness, which kills the requirement for extension sheets or "shields" to include utility. At last, these highlights enable understudies to do true designing right now from radio-controlling vehicles to making remain solitary restorative gadgets. So this brilliant stick would likewise progress toward becoming independent and free. The sensor modules that have been selected out are.

The sensor modules that have been selected out are:

1. Ultrasound sensor.
2. PIR motion sensor HC-SR501.
3. Flame sensor LM393.
4. 3-axis accelerometer inbuilt in Ni myRIO.

A portion of alternate prerequisites are GPS module, trouble catch we can use the catch which is available on RIO for this capacity, Buzzer, additionally alerts can likewise be given out utilizing the sound out port which is available on RIO subsequent to programming it as indicated by the condition required. The GPS module used is based on the Ublox NEO-6M. This unit uses the latest technology from Ublox to give the best possible positioning information and includes a larger built-in 25 x 25mm active GPS antenna with a UART TTL socket. The power supply to this device is through a 12V battery with 9000mAh which is connected externally. The most crucial part of this project is to interface different types of sensors with RIO and to monitor the communication of different types of data like analog and digital between RIO and sensors. It has I/O pins consisting of serial port protocols such as SPI, I2C, and UART (Tx and Rx), which make it easier to communicate with the sensor and peripheral modules. Also, the data from the I/0 pins can be accessed directly without the need of writing any code and can be displayed or processed directly. Since RIO can be connected through Wi-Fi, this can be used to send the warnings to the relatives of the user through the mail using SMT protocol in case of emergencies. So there is no need to use another GSM module for providing connectivity to the user with an IoT server.

E.Software:

LabVIEW is a graphical programming condition that can be utilized to rapidly create applications that scale over different stages and OSs. The intensity of LabVIEW is in its capacity to interface with a great many gadgets and instruments utilizing several inherent libraries and prebuilt VIs to enable you to quicken improvement time and rapidly secure, examine, and present information. Instead of investing bountiful measures of energy investigating code sentence structure or creating UIs, understudies can utilize the LabVIEW software to focus on constructing their systems and solving their design problems without the added pressure of a burdensome tool. Applications in LabVIEW mimic the appearance of real instruments (like multimeters, signal generators, or oscilloscopes), so they are called virtual instruments or VI's Every LabVIEW application has a front panel, an icon/connector pane, and a block diagram. The front panel serves as the imitation of the real world user interface of the device that the VI is defining. In summary, LabVIEWVIs are graphical, driven by dataflow and event-based programming, and are multi-target and multiplatform capable.They also have object-oriented flexibility and multithreading and parallelism features. LabVIEWVIs can be deployed to real-time and FPGA targets. So we design the required VI in LabVIEW and connect it to RIO for the execution of the connected hardware component, thus obtaining the required prototype.

III. RESULTS

Utilizing myRIO we can constantly transmit the definite GPS area of stick holder to the chose rundown of contacts. GPS is a quick, exact and shoddy framework for distinguishing proof of mishap areas. It gives the limitation in the geographic directions viz., scope and longitude. Its favorable circumstances comprising GIS (Geographic Information System) are held broadly so they are valuable for security examination issues - street mishap areas and spots with progressively number of mishap focus can be effectively separated. Distinctive foundation maps can be utilized advantageously. The restriction is to be performed following the assault happened, so as to keep dismalness mortality coming about because of the fall and additionally. An operative prototype of 3-axis accelerometer based fall detection system along with various other modules was materialized successfully on the walking stick. It is important to note that the stick holding person should be well informed about the functionality of the stick and most particularly about the distress/SOS button.Our approach towards the design of the smart walking stick is simple and fool-proof. All the modules are interfaced through RIO and since all the sensors are compact, the stick is easy to carry and also the RIO works with the help of a battery, so no need to worry about power consumption as the sensors that we have used consume very low power. Since we have interfaced various types of sensors which are generally not interfaced, we increased the functionality of our walking stick to both indoors and outdoors. And in case of emergencies the user can alert the contacts of the same with SOS call button through the mail, they can also receive the location of the user with this action.

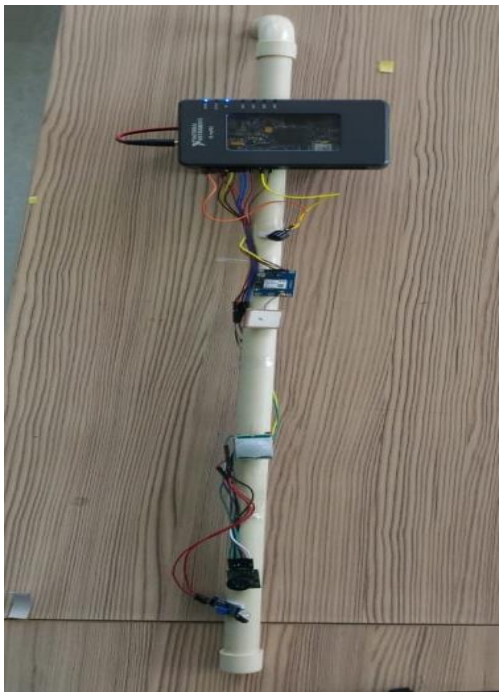

Figure 8. *Prototype*

IV. CONCLUSION AND FUTURE SCOPE

We practically designed a prototype of an electronic system that helps an assailable/unsafe person to be connected with /alert his/her family in times of danger. While most appliances marketed as 'smart walking stick' incorporate only GPS connectivity with some basic features, our project envelopes fall detection, hazard detection, obstacle detection and combine these with the Internet of Things to give a practical solution that puts the technology in service to those in need. In the future, this project can be extended by interfacing a camera to the walking stick. The live video feed of the camera is processed continuously using various digital image processing techniques and by connecting it to a cloud, the surroundings of the person can be estimated and instructions can be given according to it. Whereas this requires High Definition camera, continuous connectivity to high-speed internet, complex data processing techniques, high-speed processor and a cloud server in a remote location.

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