Research Article

A Smart Walking Stick for Visually Impaired and Deaf People with GSM Using Arduino

Aida Nurazalilla Binti Ali Hassan[1,*], Fariza Binti Mahyan[2], and Spancer Anak Geraman[3].

1 Faculty of Electrical, Politeknik Kuching Sarawak; aida.n@poliku.edu.my.
2 Faculty of Electrical, Politeknik Kuching Sarawak; farizamahyan@poliku.edu.my.
3 Faculty of Electrical, Politeknik Kuching Sarawak; spancergerman@gmail.com.
* Correspondence: aida.n@poliku.edu.my; 013-8077534

Abstract: *All of these persons with visual impairments, who have various types of disabilities, struggle with a variety of issues on a daily basis. The most difficult aspect of independent mobility for someone who is blind or visually impaired is moving, particularly in an environment that was not planned and built with them in mind. This smart walking stick based on microcontroller, Infrared (IR) sensor, water sensor, Global System for Mobile Communications (GSM), Global Positioning System (GPS) and other modules which is ultrasonic sensors for visually impaired and deaf people. This stick aids those who are blind in spotting obstacles by employing ultrasonic sensors. The stick can reliably identify obstructions within 50 cm, buzzer 1, and the vibration motor will be activated. The wet ground surface had been identified by employing a water sensor. The vibration motor, buzzer 2, and water sensor will all be turned on simultaneously. A different beep will be produced by buzzer 2 compared with the ultrasonic sensor. The vibration motor and voice coding module will also turn on because of the IR sensor detecting the fire around it. Instead of buzzer, the warning system uses a real human voice via voice recording module and adding vibration has also been included in the circuit. It's also difficult to follow a visually impaired person. To solve this problem, the stick sends real-time GPS data to the server, which allows the person to be easily located by sending the SOS message/call to their family with only just one click. The microcontroller used in this system (stick) is a type of Arduino which is programmed in C language (Dey, Paul, Ghosh, Mukherjee & Dey, 2018).*

Keywords: smart walking stick; Arduino; GSM.

1. INTRODUCTION

It is beyond emphasizing that everyone uses two gifts (eyes) that were given to us by our creator in practically all the daily activities that they partake in. Activities include things like reading, writing, coding, walking, eating, driving, and jogging. The most priceless gift anyone has ever been given is sight, which is almost universally acknowledged. Nobody likes to have vision issues, but millions of people do across the globe. Some of them are short-sighted, unable to see clearly until they are close to something, while others are long-sighted, unable to see clearly unless they are far away. The many visual abnormalities previously stated can be easily remedied at some point, but occasionally a condition results in a full loss of vision and the person becomes entirely blind, which is frequently irreversible. According to estimates, 1.3 billion individuals worldwide experience some form of vision impairment. There are 36 million blind people and at least 216 million people who have moderate to severe visual impairments globally (Nahar, Nikam & Deore, 2016).

Although there are numerous degrees or varieties of vision impairment, I've attempted to concentrate on the concerns that visually impaired people encounter daily rather than talk about what causes blindness or other disorders. Additionally, those who are deaf have limited alertness to overcome and have attempted to decrease their issues in the same manner as others. By working on

this initiative, they seek to eliminate or lessen the difficulties that blind and deaf people currently face. A fresh and somewhat different approach (a smart walking stick for visually impaired and deaf people) can be developed by making this project and adding other features to lessen their problems.

2. PROBLEM STATEMENT

By using a standard blind stick, blind persons have difficulty recognising stairs or impediments. A vibrating system that will satisfy client desire hasn't been developed by many researchers. As an illustration, imagine that the user or the blind person is also having problems with their audio acuity. Simple audio equipment or a pointless vibrating system won't aid them in this situation. A certain amount of vibration and beeping is required from the buzzer and vibrator. Blind people are more likely to have accidents or unintentionally enter unsafe locations like lakes, construction sites, and fires because they lack the vision to read the warning signs outside. When a blind person walks by themselves outside of our line of sight, it might be challenging to follow them (Kumar, Kabir & Roy, 2017).

3. METHOD & MATERIAL

This project is designed and simulated using Tinker CAD software, and the code is compiled with the Arduino IDE. The design of the controller uses a closed-loop system with Arduino as the main controller. This project uses a push button, an emergency switch, an ultrasonic sensor, a water sensor, and an IR sensor as inputs and a buzzer, a vibrating system, a voice recording module, GSM, and GPS as outputs.

3.1 Sensor system

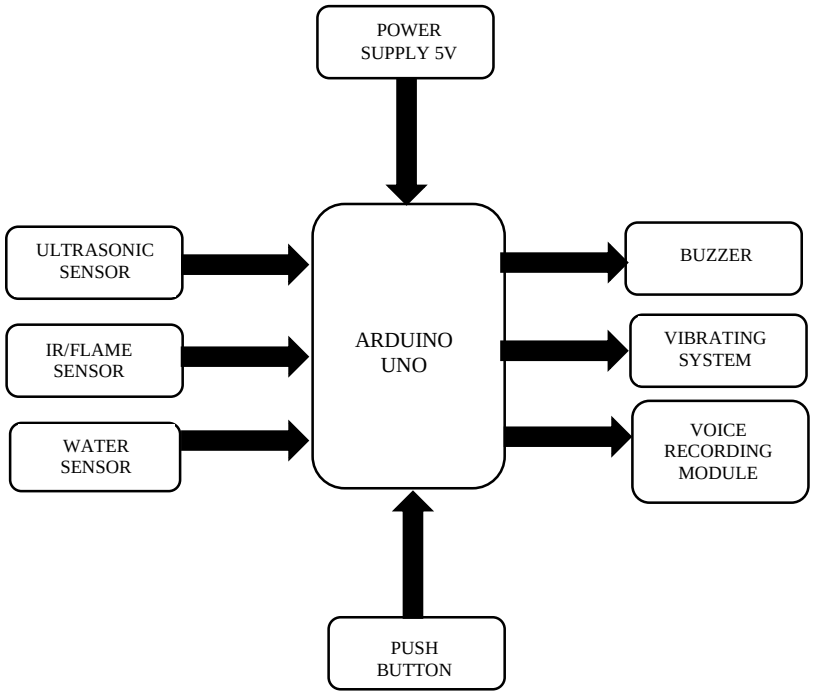

Figure 1. Block Diagram of the project

Figure 1 shows the block diagram of this project. The circuit has been supplied with 5V. The main input of the components consists of an ultrasonic sensor, an IR/flame sensor, and a water sensor. All these sensors have their own function to detect obstacles, fire, and water. While the output of this project are buzzer, vibrating system and voice recording module. When the smart blind stick is activated by pressing the push button, the three sensors are ready to operate. For an ultrasonic sensor, if the sensor detects any obstacle below 50cm, it will trigger the buzzer 1 and vibration motor. Secondly, when the water sensor is activated, it will trigger buzzer 2 and the vibration motor when the water value is above 50 ml. Then, the IR/flame sensor will detect the fire surrounding it. When it detects the presence of fire, it will trigger the voice recording module and vibration motor (Nahar, Nikam & Deore, 2016).

3.2 GPS and GSM system

Figure 2 shows the block diagram for the GPS and GSM circuits. This circuit need supply 5 V. The main controller for this system is also the Arduino UNO. The inputs for this part are an emergency switch and a push button, while GPS and GSM are the outputs. When the user presses the button on the blind stick, the input signal activates the GPS and GSM, which then go online automatically. It will find the signal and register the emergency number. Then, if the user presses the button again, GPS will trace the user's location and GSM will read the data and transmit the alert message simultaneously. Finally, the registered number will receive the location (Ghosh, Bose & Kudeshia, 2020).

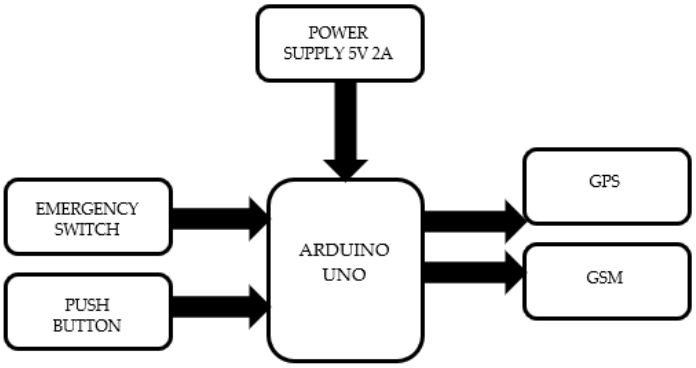

Figure 2. Block Diagram for GPS & GSM circuit

3.3 Complete Circuit

The Arduino is the primary component used as a microcontroller in this project. The board's sets of digital and analogue input/output (I/O) pins can be used to interface with a variety of expansion boards (shields) and other circuits. The board has 14 digital I/O pins, six of which can be utilized for PWM output, six digital I/O pins, and six analogue I/O pins. With a type-B USB connector and the Arduino IDE (integrated development environment), it may be programmed. It can be powered by a USB cable or an external 9-volt battery in addition to the voltage range of 7 to 20 volts. In some ways, it is like the Arduino Nano and Leonardo. A creative commons attribution share-alike 2.5 license is attached to the hardware reference design, which is available on the Arduino website. Additional layout and production files are offered for different hardware iterations.

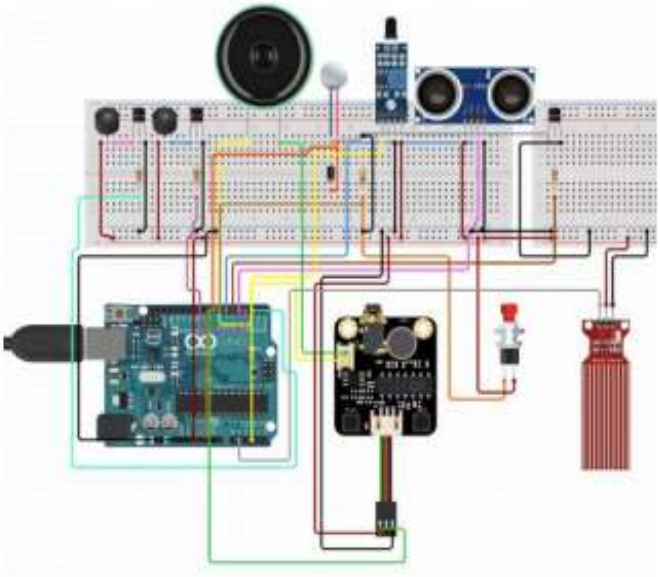

Figure 3. Combination of a complete circuit

4. MECHANICAL DESIGN / PRODUCT LAYOUT

The product that incorporates the sustainability component in the design idea is shown in Figure 4. There are a few sustainability components in this project. First off, the project is eco-friendly and I don't utilise any resources or equipment that could damage the environment. Second, the project has an ergonomic approach, and my goal is to offer a user-friendly design. Apart than that, the project only uses a small amount of power to run. The wire was totally enclosed into the stick for safety, which can lessen the electric shock. Last but not least, the attraction is to assist the disabled and assist them in being more self-reliant.

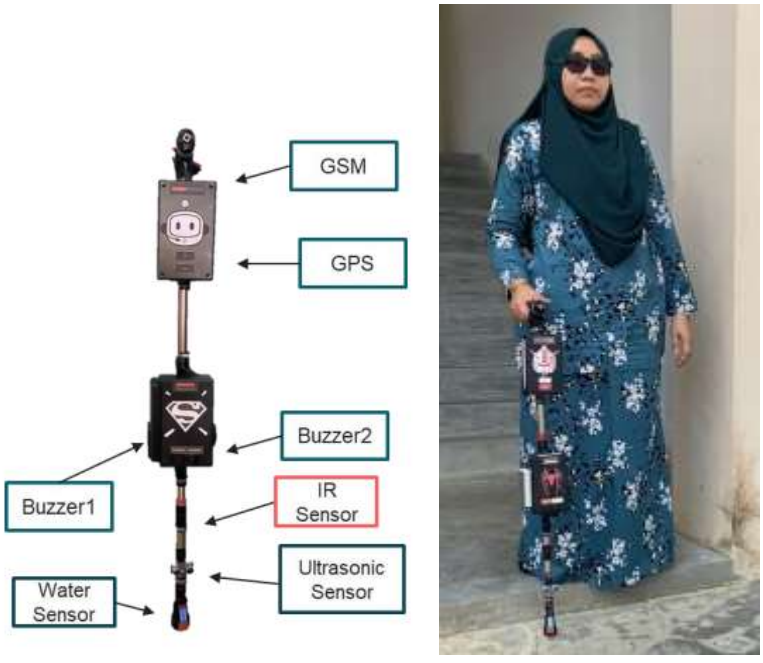

Figure 4. Product of this project

5. RESULTS

Smart walking stick combines several circuit which is Ultrasonic sensor, IR sensor and Water sensor circuit. The circuit also consist of three various output that will be triggered depending on the input such as buzzer, vibration motor and voice recording module. Table 1 shows that when the ultrasonic sensor detected an obstacle 50 cm away, buzzer 1 and the vibration motor activated. If the IR sensor detects fire, the buzzer will go on, and the vibration motor and voice coding module will become active. When the blind stick detects water around 50 ml, the water sensor will be active, buzzer 2 will sound, and the vibration motor will be activated (Kunta,Tuniki & Sairam, 2020).

Table 1. *Sensors online status*

Components Online Status	Buzzer	Vibration Motor	Voice Recording Module
Ultrasonic sensor	ON	ON	OFF
IR sensor	ON	ON	ON
Water sensor	ON	ON	OFF

Table 2 shows the GSM and GPS activated status. The input for this system is provided by a push button and an SOS button. Firstly, when the user switches the push button, it will send an input signal to the GPS and GSM. Then, it will automatically send a message that contains the current location of the user to the registered emergency number. Apart from that, when the SOS button is triggered, the GSM will make a call to the registered emergency number (Ghosh, Bose & Kudeshia, 2020).

Table 2. *GSM and GPS online status*

Type of switch	Call	Message	Location
Push Button	NO	YES	YES
SOS Button	YES	NO	NO

4. CONCLUSION

The project's objective of creating a smart blind stick was achieved. This stick's design is intended for blind and deaf persons who use GSM and Arduino. Ultrasonic sensors, IR sensors, and water sensors are all controlled by the main controller, Arduino. As outputs, the device has a buzzer, a vibrating system, a voice recording module, GSM, and GPS. Obstacles will be detected by the ultrasonic sensor at 50 cm. A water sensor will turn on buzzer 2 and the vibration motor when it detects water of about 50 ml. A different auditory feedback pattern is emitted by each sensor. Additionally, the stick can warn the user of any threats that could endanger their lives, especially if they are deaf or have vision problems. When the user presses the switch, the GSM and GPS will be operational. A location and message will then be immediately sent to the designated emergency number.

References

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