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SMART BLIND STICK

A MINI PROJECT REPORT

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ABSTRACT

Visually impaired people find it a lot difficult to detect any sorts of obstacles in their surrounding environment. They have very little contact with their surroundings. Physical movement is a challenge to these people, because it becomes tricky to distinguish obstacles in front of them, making it hard for them to move around from one place to another.

A smart blind stick is an innovative device that detects the obstacles in front of the visually disabled people, it's designed to provide an improved navigation.

We here propose a blind stick that allows the blind persons to navigate around with comfort using the help of technology. This stick is integrated with ultrasonic sensors and LDR sensors. With the help of ultrasonic sensors the stick detects the obstacles ahead of the person using ultrasonic waves. Further this data is passed to the microcontroller, where the data is processed and the distance of the obstacle is calculated. If the obstacle is located close, then the microcontroller sends a signal to the buzzer, and if the obstacle is not close enough then the circuit does nothing.

The project of ours has one more advanced feature in order to help the blind to locate their stick just in case they have misplaced it. We have used a wireless radio frequency based remote for this purpose. Pressing of the remote initiates the buzzer on the stick, which therefore helps the visually disabled to locate their stick.

Thus this is a project which is beneficial to the visually impaired people to locomote from one place to another with ease, by locating the obstacles ahead of them and warning them such that they can change their path of movement, and also helps them find their stick as and when they are in need.

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CHAPTER 1

1.1 INTRODUCTION

According to a global estimate, there are at least 2.2 billion people who have a vision impairment or blindness, out of which at least one billion of them have a vision impairment that could have been prevented or is yet to be addressed.

The International Classification of Diseases has classified the vision impairment into 2 groups, one is the distance vision impairment and the other the near vision impairment.

Distance vision impairment:

Mild: presents the visual acuity which is worse than 6/12

Moderate: presents the visual acuity which is worse than 6/18

Severe: presents the visual acuity which is worse than 6/60 Blindness:

presents the visual acuity which is worse than 3/60

Near vision impairment:

Presents the near visual acuity worse than N6 or M.08 with the present correction.

An individual's encounter of vision disability shifts relying on a wide range of variables. This incorporates for instance, the accessibility of anticipation and treatment mediations, access to vision restoration (counting assistive items, for example, glasses or white sticks), and whether the individual encounters issues with difficulty to reach structures, transport and data.

Out of the 2.2 billion people, 1 billion of them include those with moderate or severe distance vision impairment due to unaddressed refractive error, as well as near vision impairment.

Worldwide, leading causes of the vision impairment are the uncorrected refractive errors and cataracts.

Most of the people in the world with vision impairment are the ones who are over the age of fifty years.

Currently we have a whole lot of people suffering from a common problem all over the globe. These include people from low sight-seeing to complete loss of vision. They find a lot of difficulty in crossing the road or reaching their respective destination without the help of any other individual. We need to come up with an aid which would benefit them, and make their lives easier.

The one such aid which is currently available is the traditional stick, but it does not help to detect the obstacles or the potholes in the path of the blind. It is also outdated.

Hence there is a need to update it using today's technology. The smart stick, which our project is all about is a device for the visually impaired to guide the user to the respective destination and to avoid colliding with the obstacles. It uses sensors to detect the obstacles, along with which it uses Arduino as the main controller. Whenever there is any obstacle in front, the sensor will detect the obstacle from a distance and convey it to the controller. The controller will then convert in audio format.

This way the blind can be warned about what’s in around them and hence would be beneficial for them to locomote from one place to another.

The objective of our project is an attempt to develop an aid for visually impaired persons. This project is a smart stick which is capable of detecting any obstacle, detect light and corners and even allow the user to find the stick if anyhow missed by the user by pressing a remote switch.

The smart stick comes as a proposed solution to enable the blind to identify the world around. The stick is capable of detecting all obstacles in the range 4 meter and gives a suitable message which acts as a warning alarm.

The smart walking stick is a simple and a mechanical device to detect the obstacles on the ground. This device is lightweight and portable. But its range is limited due to its size. It provides the best travel aid for the person. The blind person will now be able to move from place to place independently without anyone’s help. Main aim of this device is to provide efficient navigation aid for the blind people.

1.2 LITERATURE SURVEY

Paper [1] Title: Smart Stick for the Blind a total solution for arrival at the destination. This framework utilizes IR sensor, Ultrasound sensor and water sensor to distinguish the obstacle. In any case, this framework just gives a caution if any of the sensor is activated, it utilizes a signal to alarm the visually impaired individual. This framework doesn't utilize any location identifier or location marker.

Paper [2] Title: Pothole recognition for outwardly impeded which utilizes a camera that catches picture 15 edge for every second and in light of the idea of picture handling the pothole is distinguished. Issue with this system is utilization of the camera makes it costly, and furthermore a great deal of pictures caught every second expands overhead and capacity necessity.

Paper [3] Title: Smart Walking Stick for Blind depicts a Stick which uses Raspberry Pi [10] and an ultrasonic sensor to identify articles and gatecrashers, the system likewise has a camera implanted with it, and dependent on the pictures caught the items are distinguished. The articles are investigated dependent on the arrangement of picture datasets that are as of now put away. This system, as it may, turns out to be expensive because of the utilization of top of the line cameras and furthermore on account of capacity requirements as a huge volume of datasets should have been put away. This system, here and there may likewise be mistaken in light of the fact that the impediments are identified dependent on the dataset (enormous arrangement of pictures) as various articles differ in their shape and size.

Paper [4] Title: Smart Belt for Blind uses a belt implanted with ultrasound sensor which identifies the deterrent. The belt likewise has a signal which vibrates when obstruction is recognized. The whole system is created so that the separation determined is sent as a sound message for the visually impaired individual, where in which he hears the separation determined utilizing a speaker.

Paper [5] Title: A wearable ultrasonic deterrent sensor for outwardly debilitated. This system utilizes several ultrasound sensors on either side over the tie of the glasses. This undertaking can recognize the intruder before the visually impaired individual who is wearing the glasses.

This framework isn't hearty as the sensor installed with the glasses makes it heavier and furthermore it can't distinguish complex items, for example, water, vehicles and so on.

Paper [6] Title: Smart blind stick - an electronic way to deal with help outwardly impaired people by Mohammad Hazzaz Mahmud, RanaSaha, and Sayemul Islam. In this paper the sensor based hardware consisting of sensors Ultrasonic Sensor is utilized to identify deterrents, A PIC16F690 microcontroller peruses these sensors and drives a signal, a LED and an engine with PWM. A sound yield is assigned by a bell caution.

Paper[7] Title: Arm7 Based Electronic Travel Aid System for Blind People Navigation and Monitoring V. S. M. Madhulika S #1, M. S. Madhan Mohan#2, CH.Sridevi#3, T. V. Janardhana rao#4. This paper focuses on the improvement of an Electronic Traveling Aid (ETA) pack to assist visually impaired individuals with finding obstacle freeways. This ETA is fixed to the stick of the visually impaired individuals. At the point when the article is identified close to the blinds' stick it cautions them with the assistance of vibratory circuit (speakers or headphones).The framework comprises ultrasonic sensor, GPS Module, GSM Module and vibratory circuit (speakers or earphones). The area of the visually impaired is discovered utilizing Global System for Mobile interchanges (GSM) and Global Position System (GPS).

CHAPTER 2

THEORY

2.1 Existing System:

There are over 2.2 billion people in the world who have visual impairment, most of them are currently using the traditional blind stick in order to travel around, which makes it very difficult for them.

Therefore, for blind people, it became hard for them to fit in and live a normal life, that's why they would either use an ordinary white cane, a dog, or the help of others. This is the existing system for the blind.

2.2 Proposed System:

The system produced by us is advanced and helps out the blind even better, it involves in an ultrasonic sensor which senses the distance from any obstacle, a LDR which is used to sense the lighting conditions, and a RF remote which is used by the blind to locate the stick. All the feedback will be conveyed using a buzzer. The ultrasonic sensor senses the distance between the man and the obstacle. If the distance is less the signal passes on to the buzzer, which then beeps. If the distance is safe enough then the device doesn't give any alarm to the user. While the LDR sensor is used to know the intensity of light and helps the bliinnd person differentiate between light and dark places.

2.2.1 Ultrasonic sensors

An ultrasonic sensor is basically an instrument that measures the distance to an object using ultrasonic sound waves. An ultrasonic sensor uses a transducer to send and receive ultrasonic pulses that gives us information about the proximity of an object. These sensors emit sound waves at a high frequency which is too high for humans to hear. When the sound is reflected back, the distance is calculated based on the time taken. This is similar to how the radar measures the time it takes for a radio wave to return after hitting an object.

2.2.2 LDR Sensor

An LDR is a component that has a variable resistance that changes with the light intensity that falls upon it, this allows them to be used in light sensing circuits. These devices depend on the light that fall on them, the resistance will decrease when the light falls on the LDR and the resistance will increase when there is no light, that is, when it is dark. Therefore, when a LDR is kept in the dark place, its resistance is high and, when the LDR is kept in the light's resistance will decrease.

2.2.3 Water Sensor

The proposed system uses NE555 timer and the concept of conduction to sense the water in case there's a puddle or water in front of the blind man.

2.2.4 Calling the stick

Our project also has a remote which helps in finding the stick, if in case it has been misplaced by the owner. The working principle behind this is that we have used a RF transmitter which receives serial data and transmits it to the receiver. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. The serial data transmitted by the remote is received by the blind stick, and thus helps in locating the stick.

This way the technology and the ideas used in this project proves to be a lot beneficial to the ones in need, than the old conventional methods which are currently available.

CHAPTER 3

3.1 COMPONENTS REQUIRED:

1. Arduino
2. Ultrasonic Sensor HC-SR04
3. LDR
4. Buzzer
5. 7805 IC
6. 433MHz RF transmitter and receiver
7. Resistors
8. Push button
9. Bread board
10. NE555 Timer
11. 9V battery

3.2 DESCRIPTION OF COMPONENTS:

3.2.1 ARDUINO NANO:

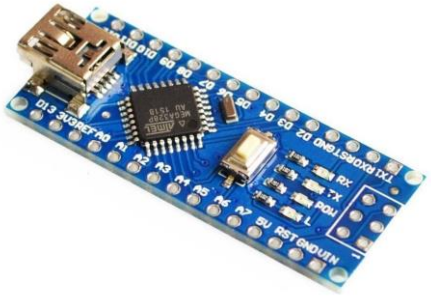


Figure 1. Arduino Nano

The Arduino Nano is a small, breadboard-friendly microcontroller chip which is based on the ATmega328p microchip which can be easily programmed in the universal programming language, C++. It is equipped with a decent amount of memory for any project. This microcontroller can be powered by an external 9v battery.

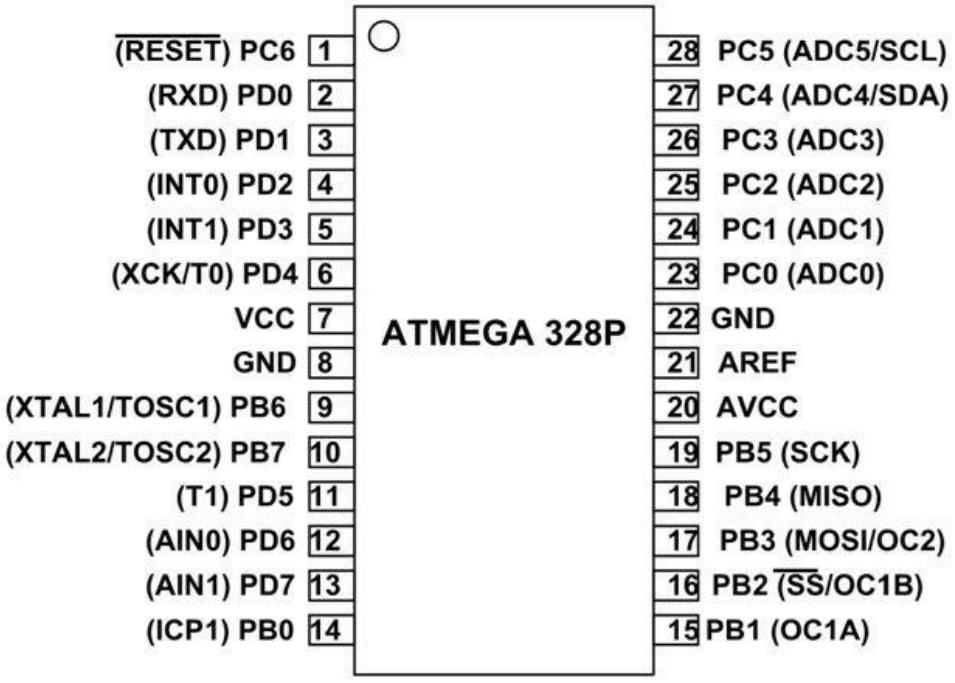


Figure 2. Pin configuration of Atmega 328P

Pin Number	Description	Function
1	PC6	Reset
2	PD0	Digital Pin (RX)
3	PD1	Digital Pin (TX)
4	PD2	Digital Pin
5	PD3	Digital Pin (PWM)
6	PD4	Digital Pin
7	Vcc	Positive Voltage (Power)
8	GND	Ground
9	XTAL 1	Crystal Oscillator
10	XTAL 2	Crystal Oscillator
11	PD5	Digital Pin (PWM)
12	PD6	Digital Pin (PWM)
13	PD7	Digital Pin
14	PB0	Digital Pin
15	PB1	Digital Pin (PWM)
16	PB2	Digital Pin (PWM)
17	PB3	Digital Pin (PWM)
18	PB4	Digital Pin

19	PB5	Digital Pin
20	AVCC	Positive voltage for ADC (power)
21	AREF	Reference Voltage
22	GND	Ground
23	PC0	Analog Input
24	PC1	Analog Input
25	PC2	Analog Input
26	PC3	Analog Input
27	PC4	Analog Input
28	PC5	Analog Input

Table 1. Pin numbers of Atmega 328P

3.2.2 ULTRASONIC SENSOR:

Figure 3. Ultrasonic sensor

They can measure distances using SONAR. It consists of two parts, a transmitter and a receiver. The transmitter emits the ultrasonic waves. The receiver detects the reflecting signals from the objects. These sensors work on a principle called “The Time of flight” using the speed of sound. The sensor emits a range of pulses between 20 KHz to 200 KHz. When the pulse impacts an object and then reflects, the receiver of the sensor will be able to detect this signal.

Pin Number	Pin Name	Description
1	Vcc	The Vcc pin powers the sensor, typically with +5V
2	Trigger	Trigger pin is an Input pin. This pin has to be kept high for 10us
		to initialize measurement by sending ultrasonic wave.
3	Echo	Echo pin is an Output pin. This pin goes high for a period of time and will be equal to the time taken by the ultrasonic wave to return back to the sensor.
4	Ground	Ground pin is connected to the Ground of the system.

Table 2. Pin description of ultrasonic sensor

3.2.3 LDR:

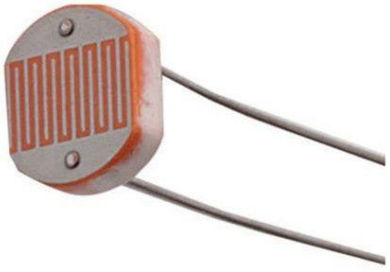


Figure 4. LDR Sensor

An LDR is a Light Dependent Resistor. It is a component that has a resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits. This

sensor identifies dark and light places. It is connected to the A1 pin of Arduino board. The inbuilt ADC of the controller converts the analog voltage provided by the LDR into a digital reading.

3.2.4 BUZZER:

Figure 5. Piezzo buzzer

A buzzer is a small speaker which will be connected directly to an Arduino. The buzzer is active whenever an obstacle is detected by the ultrasonic sensor, bright light or a dark spot is detected by LDR, water is detected by the stick or when the remote is pressed indicating a missing alert by the RF circuit.

3.2.5 7805 IC:

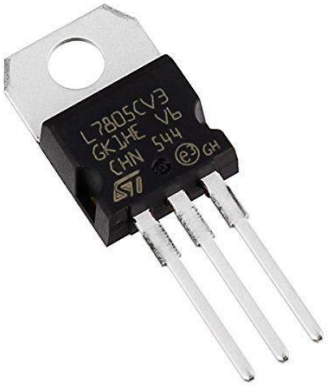
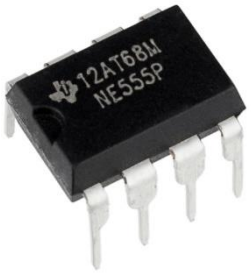


Figure 6. 7805 IC

7805 IC is a voltage regulator that restricts the output voltage to 5v for various ranges of input voltages.

3.2.6 NE555 IC



The NE555 Timer IC is a commonly used IC designed to produce a variety of output waveforms. In the proposed system, we use the NE555 timer for detecting water.

3.2.6 RF TRANSMITTER AND RECEIVER:

Figure 7. RF transmitter and receiver

An RF transmitter receives serial data and transmits it to the receiver. The transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter. It specifically operates at a frequency of 433MHz.

3.2.7 9V BATTERY:

Figure 8. 9v battery

9v battery is used to provide the power supply to both the circuits. In the main circuit, the 7805 IC regulates the voltage and provides an output of 5v**.**

CHAPTER 4 PROJECT DESCRIPTION

4.1 BLOCK DIAGRAM:

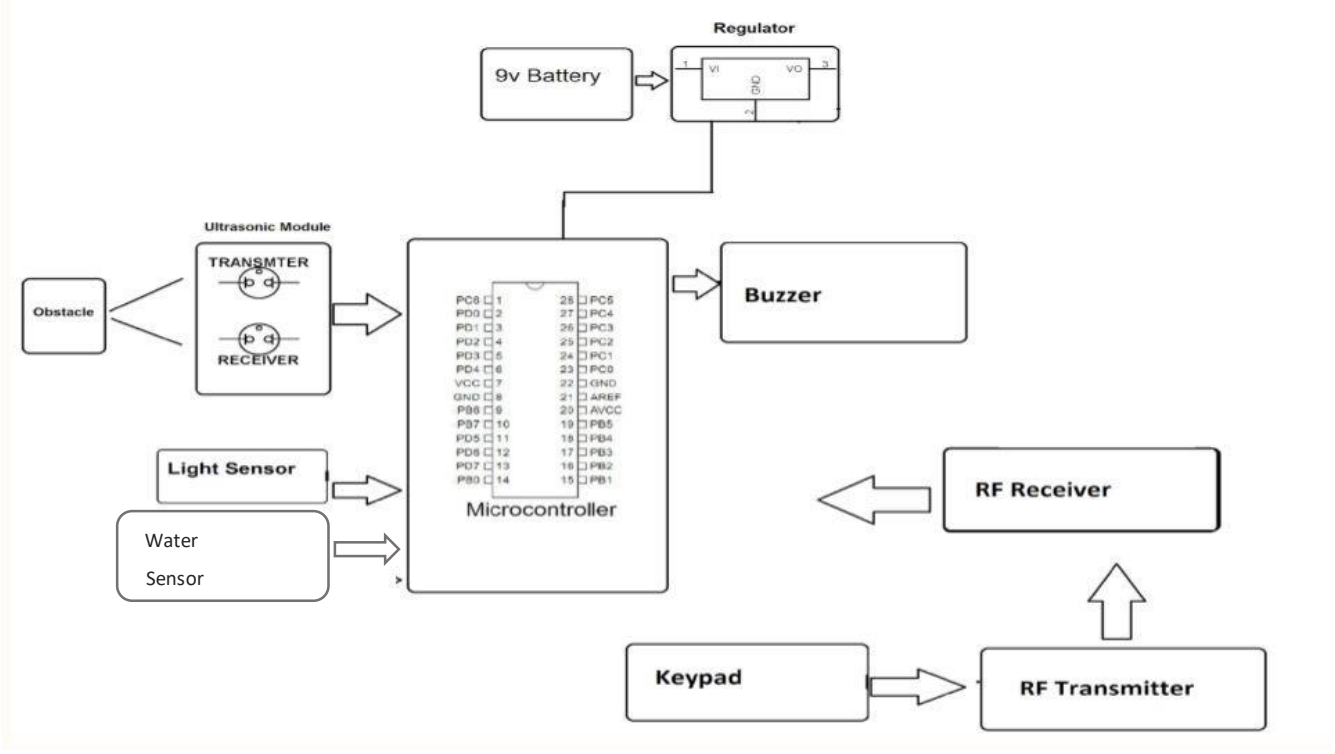


Figure 8. Block diagram of the proposed system

Fig. 8 shows the flow of information in the proposed system. As mentioned previously, the ultrasonic sensor consists of two ultrasonic transducers, a transmitter and a receiver. The transmitter transmits a high frequency ultrasonic wave and when this wave detects an obstacle, it bounces back. The wave which is reflected is received by the receiver. The distance between

the sensor and the object is calculated using the formula. This ultrasonic sensor is connected to the arduino.

Therefore, when an obstacle is present in front of the blind man, the ultrasonic sensor senses the obstacle and the echo pin of the sensor goes high for the amount of the taken by the receiver to receive the signal. This amount of time is measured by the microcontroller as it gives information about the time taken by the wave to return back to the sensor. Using this information, the distance is measured and the microcontroller gives output to the buzzer to beep accordingly.

We use the LDR sensor so that the blind man can differentiate between light and dark places. The LDR is connected to a 10 ohm resistor to provide a potential difference and the difference in voltage is read by the arduino which gives output to the buzzer. Hence, the buzzer beeps when there is darkness and when the surrounding is too bright. If not, the buzzer will not beep. In case there is a puddle or water in front of the blind person, the water sensor which is constructed using the NE555 timer detects the water and alerts the blind person accordingly.

The system is powered by a 9v battery which is regulated to 5v using a voltage regulator LM7805 IC.

Coming to the working of the remote, if the blind person is having trouble finding the smart blind stick, he/she can press the button on the remote which is connected to an RF transmitter and the arduino will be able to receive information using the receiver which gives output to the buzzer and the buzzer beeps. The transmitter operates at a particular frequency 434 MHz and will transmit the data serially through radio frequency and the receiver operating at the same frequency will receive the data.

4.2 CIRCUIT DIAGRAM AND WORKING:

The proposed system, the Arduino Smart Blind Stick Project requires two separate circuits. One is the main circuit which will be mounted on the blind man's stick and the other is a small remote RF transmitter circuit which will be used to locate the main circuit.

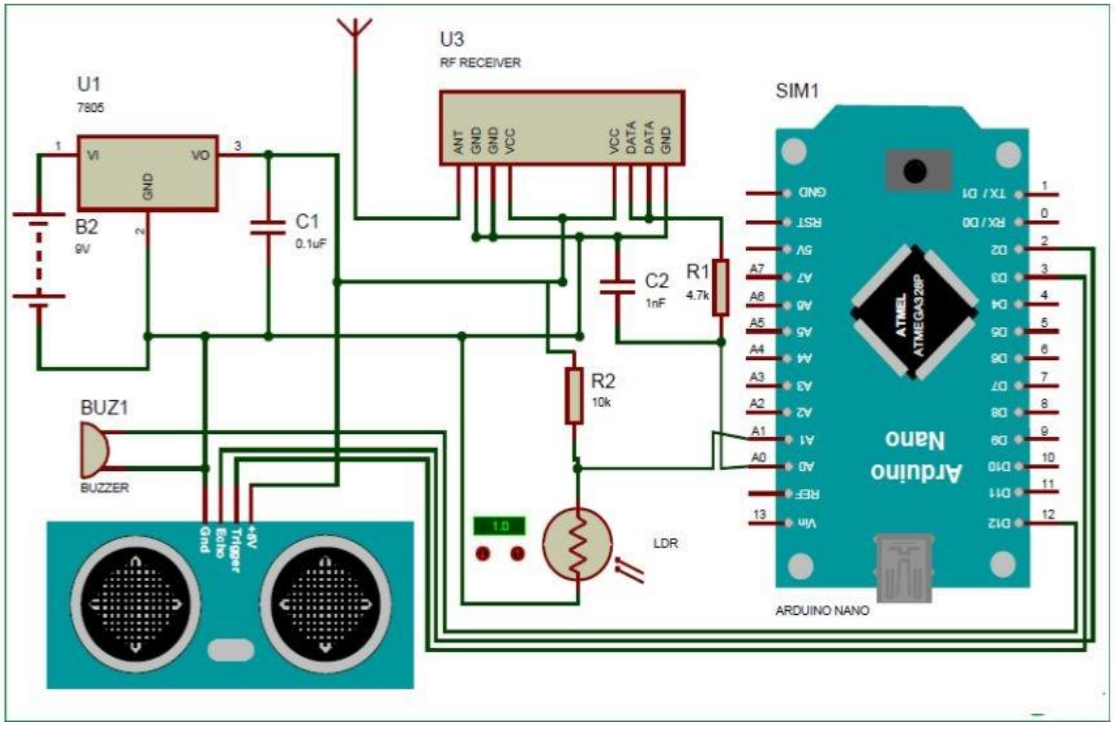


Figure 9. Circuit diagram of the proposed system

As seen in the circuit diagram, an Arduino Nano is used to control all the sensors. This board is powered by a 9V battery which is regulated to +5V. We use the 7085 voltage regulator to regulate the 9v battery to 5v.

The Ultrasonic sensor is powered by 5V and the Echo pin and trigger is connected to Arduino Nano pin 2 and 3. A 10k resistor is connected to the LDR to form a Potential divider and the Arduino ADC pin A1 reads the difference in voltage. The signal from the RF receiver is read by the ADC pin A0. The buzzer is connected to pin 12 which gives the output of the board.

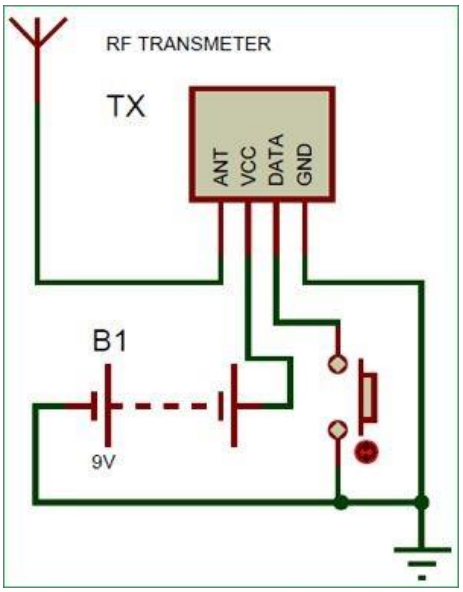


Figure 10. Circuit Diagram of the remote that is used to call the stick

For the remote which detects the stick, we just need the receiver to detect if the transmitter is sending some signals. Hence, the Data pin of the transmitter is connected to Ground or Vcc of the supply.

Whereas the data pin of the receiver is passed through an RC filter and then given to the Arduino. The Receiver outputs some constant ADC value repeatedly whenever the button is pressed. This repetition can be observed only when the button is pressed.

We can write the Arduino program to check for repeated values to detect if the button is pressed. So that is how a Blind person can track his stick.

To test the proposed system, we have to make sure that the connections are done right as per the circuit diagram and the program is successfully uploaded. Power both the circuits using a 9V battery and we can start to see the results. When the Ultra Sonic sensor is moved closer to the object, we can notice the Buzzer beeping and this beeping frequency increases as the stick goes closer to the object. If the LDR is covered in dark or if there is too much light the buzzer will beep. If everything is normal the buzzer will not beep. If there is a puddle or in case the blind person is stepping into water, the two probes present at the bottom of the stick will sense the water and alert the blind person using the buzzer.

Coming to the working of the remote, when the button on the remote is pressed, the buzzer will give a long beep.

CHAPTER 5

5.1 APPLICATIONS

- The smart blind stick is an auto detection device. It detects the obstacle with the support of indication. It gives the information of dig with indication alarm (buzzer). The smart blind stick comes as a proposed solution to enable them to identify the obstacles around.
- The system is used to enable blind people to move with the same comfort and confidence as sighted people.
- The whole system is designed to be handy, light and is used as a replacement to the white cane.
- The implemented system is cheap, fast and easy to use and an innovative affordable solution to blind and visually impaired people in the world.
- This aids as a cheaper aid to those who can’t afford costlier aids such as canes.
- Many people with serious visual impairments can travel independently wherever they want to, using a wide range of tools and techniques. Becoming familiar with an environment or route can make it much easier for a blind person to navigate successfully.

5.2 FUTURE SCOPE

The future scope of the prevailing stick is, guiding the visually impaired person in his navigation independently in a more efficient manner making sure about the person's safety.

1. The Braille input tool gives the blind individual an uncomplicated approach to provide the destination address for the navigation.
2. The programmable wheels could take the stick far away from the limitations or the obstacles and help the blind person to reach their destination safely.
3. In order to run this incorporated set of hardware we can use solar panels as a replacement to the battery. The use of a sun panel happens to be a greater advantage as it uses sunlight, the easily available renewable resource of energy, to get recharged. Using the solar panels also helps in saving the resources.
4. Global positioning system can be used in the blind stick which can assist the blind person to find out about their destination information.
5. GPS can help blind people to get source and destination route information. It can also help to find the shortest and best path according to google map.
6. GSM attachment can help in future for any instantaneous causality assessment.

Further aspects of the project can be improved by the wireless connectivity between the system components thus increasing the range of ultrasonic sensors. A technology can be implemented for determining the speed of obstacles approaching.

5.3 CONCLUSION

This report gives the design and implementation of a smart stick which we have developed, it assists a visually impaired person to their destination with secure and comfort. We have employed various sensors to come across the hurdles ahead and warn the blind person approximately through a beep sound. The depth of the beep sound will increase as the character nears the impediment which aids him or her to move aside of the obstacle. The smart blind stick acts as a basic platform for the coming generation to help the visually impaired person to be more safe. It is very effective and affordable for the people who are in need of it. It leads to a good result in detecting the obstacles lying ahead of the blind person detecting the water pits and other such barriers ahead. This device is very reliable, portable and uses very less power. It is a low cost device and also a good solution for navigation with a short response time. It's a lightweight device and easy to handle for a blind person.

The fundamental purpose of the project is to provide an aid that could discover objects or boundaries for a blind person and gives a warning when an obstacle is detected in the form of a buzzer. This challenge is an automated device that makes use of ultrasonic sensors to be detecting the barriers in front via a microcontroller.

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