Obstacle Detection for Blind People Using Ultrasonic Sensors and Ardino Processor

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Abstract: *In today's world millions of people are having problem of vision. According to the recent survey of WHO about 289 million of peoples are visually impaired. This problem makes them dependent on others. Recent studies show that about 108 different methods are used for the aid of mobility of the visually impaired people. In this project we will make the use of Ultrasonic sound to enhance the obstacle detection for the blind people within the range of 3m to 4m. The project is made by inspiring from the natural navigation system of a mammal called Bat. Although the navigation for blind using ultrasonic is a complex process but here we will present only the hurdle detection procedure. The project makes the use of UNO Arduino processor, ultrasonic sensors, 5V Buzzer, Arduino cable for burning, and some connecting wires. All this setup will be arranged on a cap, which the visually impaired person will wear. The ultrasonic emitter emits ultrasonic sound of high frequency which is perceived by the ultrasonic receiver after reflection from the obstacle and then passed to the processor for further necessary action in the form of some sound.*

INTRODUCTION

Vision is the most precious gift from the side of ALLAH ALMIGHTY. It is vision with which one can enjoy the whole beauty of life. According to Socrates, vision is life. But millions of people are visually impaired. Due to this deficiency of vision these people are left far behind in this challenging world. According to the recent survey. There are over 286 million of blind and partially sighted people in the world [1] and out of these about 90% blind solely depend on others for their survival. They face a huge problem of mobility and survival in an unknown environment.

There is an international tool as a symbol for blind people called white cane. The white cane represents a simple cane which detects static obstacles via tactile-force feedback [2]. It is a light device consisting of stick having white color and red tip. It helps to enhance the blind movement but it is limited to its size and more ever cannot be used for the detection of dynamic obstacles and that present on the floor. Another method for guiding them is the guiding dogs. These are specially trained dogs which help the visually impaired people to navigate through

the obstacle by alerting the person regarding the hurdles resulting the person to change his/her path. This method too has large number of limitations including the complex directions provided by the dogs. Also this technique is limited to about five to six years after which the dogs has to be renewed due to some natural phenomenon. These dogs are very expensive and are out of the range of the poor people to be afforded. Moreover, it is also difficult for visually impaired person to provide extra care for another living thing.

With the development of sensors after the World War 2, many devices were made to help the visually handicap people to detect the hurdles present in their surroundings. The purpose of this project is to make the use of modern technology to design such a system which could replace the white cane and guide dog to help the visually impaired people. The use of technology for such purposes is the highest moral achievement. Many devices were made to cope up with this issue but all have certain limitations along with its benefits. Here in this project we will make the use of ultrasound system by inspiring from the natural navigation of a mammal called Bat. It will make the use of high frequency sound and its reflection after striking the obstacle. For this purpose we will make the use ultrasonic sensors i.e. ultrasonic emitter and ultrasonic receiver. The reason for choosing this ultrasonic sensor since this sensor is a sensor that is the most effective in terms of distance measurements [3]. The emitter will produce the high frequency sound and after its reflection from the barrier, is received by the receptionist part of the project and then transmitted to the processor for further action.

Working principle

In this allocation of the introduction we are going to discuss the working principle. The block diagram of obstacles detector for blind people is shown below.
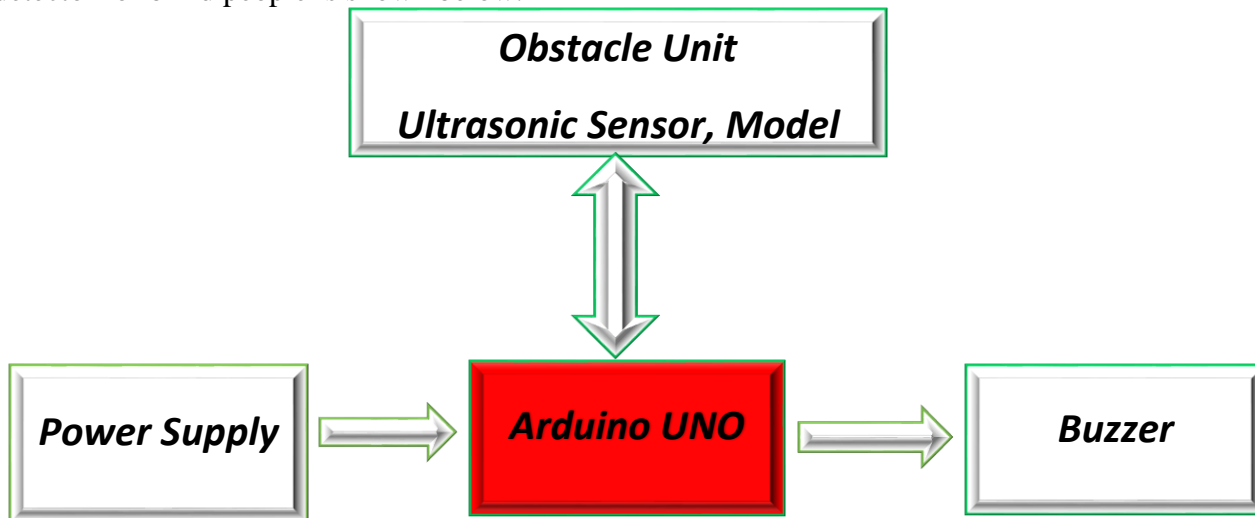

Figure 1.1: Block diagram of the system

LITRATURE REVIEV

Movement of blind pedestrian is constrained by their inability to be familiar with their ambiences. The survey of WHO in 2012 predict that about 285 million people out of 7 billion in the world are visuall worsened. Out of

these 285 million 39 million are utterly blind. About 19 million out of 39 million are childrens having age under 15 years. This clarifies that in each five seconds somebody get blind in the world and a child in every minute.

A study has been organized to enhance movement of blind pedesterain and particularly their capability to discover their surroundings. "Wearable systems have been developed based on new technologies: laser, sonar or stereo camera vision for environment sensing and using audio or tactile stimuli for user feedback" [4]. Certain fresh models about those techniques can be depicted by the "C-5 Laser Cane" [5] based on optical triangulation to spot obstructions up to a limit of 3.5 m forward. It needs surroundings examining and gives report on one closest impediment at a time with the aid of acoustic feedback. This system measures the obstacle distance and play a note proportional to it. This system developed in 70's for the purpose of being an approach to remove the cane as an obstacle detector. "The recent advancement making the use of stereoscopic cameras combined with a laser pointer and audio system have been developed at the University of Verona" [6].

Another development, Cy ARM [7], although it has a bit different approach but it is also a low coast and wearable.. Presently people are now bringing in front some new commercial devices in market like the Ultra Cane [8] which make the use of sonar system and send the information to the user in the form of vibrations with the aid of holder, in accordance with the behavior of obstacle. Talking Points [9] is another invention in the progress of obstacle detection for blind people. I SONIC [10] is an obstacle detecting instrument which detect the objects at head's height. The Guide Cane [11] make the use of computer to provide travel aid to the blind people.

"Currently, maximum of the marketable devices and software products, created to keep movement support, depend on mostly on the Global Positioning System (GPS) [12]". "Nevertheless, these clarifications are not always reliable due to the low correctness, signal loss and nonstarter to work in indoor surroundings [13]". "In municipal areas with extraordinary concentration of buildings the correctness error of GPS (Global Positioning System) sensors can reach up to 40 meters [14]". Due to which the instant for shades or visuals impaired peoples is so much problematical to travel from one place to alternative specially in strange place which makes it very problematical for shaded and visually impaired people to find their limit. One of them is Computer concept-based methodologies, mentioned as ETA, (Electronic Travel Aids) organize a promising alternative to resolve such complications [12]. One of the first documents was obtainable by Hench et al. [15]. Writers recommend a combination of sensor modal qualities (e.g. foot-mounted pedometer, 3-axis gyroscope and 2D laser scanner) to for assistance inside fix location. By means of visual Instantaneous Location fix and Mapping (SLAM) procedures [16], [17] it is imaginable to make an step-by-step diagram of the surrounding, delivering instantaneously time-based position and three-dimensional coordination of the user. In [18], a high-fidelity visualization system that approximations a three-dimensional map of area through a six-degree of freedom ego movement algorithm is presented. The resulted map is then used to distinguish top -level hurdles during the user direction finding in this device a directing finding system is used for shaded or visual impaired peoples.

Shaded people as a superior collection in culture, the requirement of culture to stretch them extra carefulness and attention.so that they are superior proficient live self-sufficiently.so some devices are deliberate which are in stock. [19] So we deliberate and execute a keen cane for hindrance detection and direction finding. Their suggested device applied water sensor infrared, ultrasonic sensors. The GPS and GSM module are also use for detection. inform move aside. The drawback of this device is too much expansive, not foldable, and also one of disadvantage is need internet facilities.

[20]The voice enable smart waking stick for visually impaired person. [21] A sensible walking rod for shaded persons suggested. The device consist of output speaker, infrared sensor RFID technology, and android device .[22] A multi-dimensional traveling aid are proposed for visually impaired peoples using ultrasonic sensor network nest with audio assistance.

The primary method tell about the item version and then confirms if a pixel or a picture cover and to conform the learned version. In [23], a digital camera takes picture grayscale pix, then pixels are categorized into heritage or items primarily established on a neural community approach. Then, the pixels belong to the hurdles are more suitable and the pixels are eliminated. Joachim et al. [24] detect barriers make use a model for a latest peoples colour vision. Then fix location of the lens was brand new the car-attention stereo digital camera changed into used to calculate the distance modern day the object middle. In [25], a way become recommend for appearance-based total hurdles detection. First of all, the coloration picture is clarified, then transformed to HIS color place. Then the coloration histogram at the applicant's area is calculated and competed in respects histogram. The 2nd method is based on completely upon a classification of brand new objectless and find area with the best object-ness procedures. In [26], the writers advanced a method for hurdles avoidance is based on stereo vision and an unsophisticated land aircraft detection.

Modern-day attention beforehand modern-day the visually impaired consumer. Strategies by traditional RGB camcorder sketch some intrinsic boundaries with shadow, constriction, and brightness sensitivity. The usage of a stereo camcorder is pricey and needed particularly specific adjustment. Newly small-value RGBD sensors (e.g., Micros mordent Kinect) had been mostly used to complement RGB statistics with deepness, help to develop considerably functioning of brand fresh item detection. In [27], a system reads facts from Kinect and expresses them as a three-Dimension contact cloud then the land aircraft and the residence modern-day volume in front of an ultra-modern person are fined. The residence represents a hurdle. In [28], the writer suggested a method collecting depth and colour.

The study in [24] suggested the sensor-help rod for shaded persons.

MATERAILS AND MATHOD

 We had arranged a survey in District mardan to find the ratio of blind people .But before going to start our survey first we will give a brief description of the area where we are going to organize the survey.

Area of description
Mardan is a 2nd largest district which is observed in Khyber Pakhtunkhwa (KPK), Pakistan. It is truly a collection of small towns which merged and play a role of a huge administrative unit. (Coordinates of Mardan Pakistan) (latlong.net)

3.1.2. Map:

Figure 2.1: Map of Mardan District (Map of district Mardan, KPK, and Pakistan. Research gate.2018.uploaded by Luqman Khan).

3.1.2. Literacy:

The literacy ratio of the peoples (Male, Female) in district Mardan among the populace aged 10 years and above is 36.45%. It has elevated by means of 20.50% factors since 1981 when it turned into only 15.95%. The male literacy ratio is an awful lot higher at 53.50% in comparison to 18.38% for woman according the survey of (Khyber.ORG, 2005) site.

Climatic circumstances:

The summer season is extraordinarily/much hot. The temperature of district Mardan is raise up to 45 degree or 44 degree. A surprising rise of temperature observed from May also to June. Even July, August and September record quite excessive temperatures. Throughout can also and June dirt storms are common at night. The temperature reaches to its maximum in the month of June i.e. 45 °C (110.3°F). Due to in depth cultivation and synthetic irrigation the tract is humid and heat is oppressive (warmth Index sixty nine on 7 July 2006).

Survey of blind peoples in district Mardan, Pakistan:
Survey details:

In district Mardan we had made a deep survey by visiting various hospitals, public places in order to know the number of blind people visitors the place in a particular interval of time. Furthermore to known about blind people we personally visited blind people and collected the data from them in our designed form. For each percentage we will provide a separate bar graph and a little description with each.

Ratio of blind peoples in district Mardan:

| Place	Total people visiting per day	Duration (Days)	No. of Blind visiting	No. of Blind visiting per day
MMC	5000	1	4	4
DHQ Mardan	4500	1	3	3
Public Store 1	2000	7	2	0.29
Public store 2	3000	7	3	0.43
NADRA office Mardan	1500	7	2	0.29
Private Hospital 1	500	15	1	0.07
Private Hospital 2	300	15	1	0.07
Total	16,800			8.15

Table 1. Total samples

From the above table we find out that the ratio of blind people in district Mardan is 0.049%.

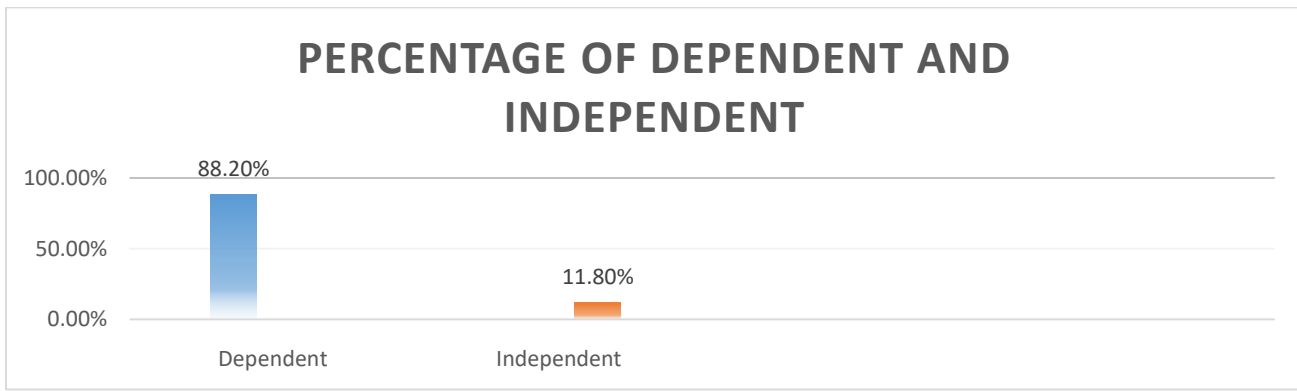**Percentage of literate and illiterate:**
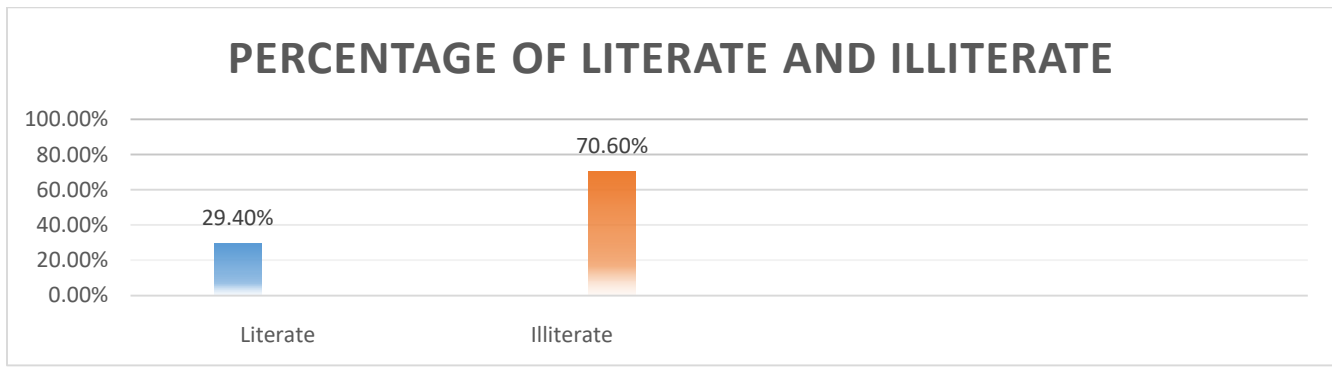
Figure 2.2: Percentage of literate and illiterate
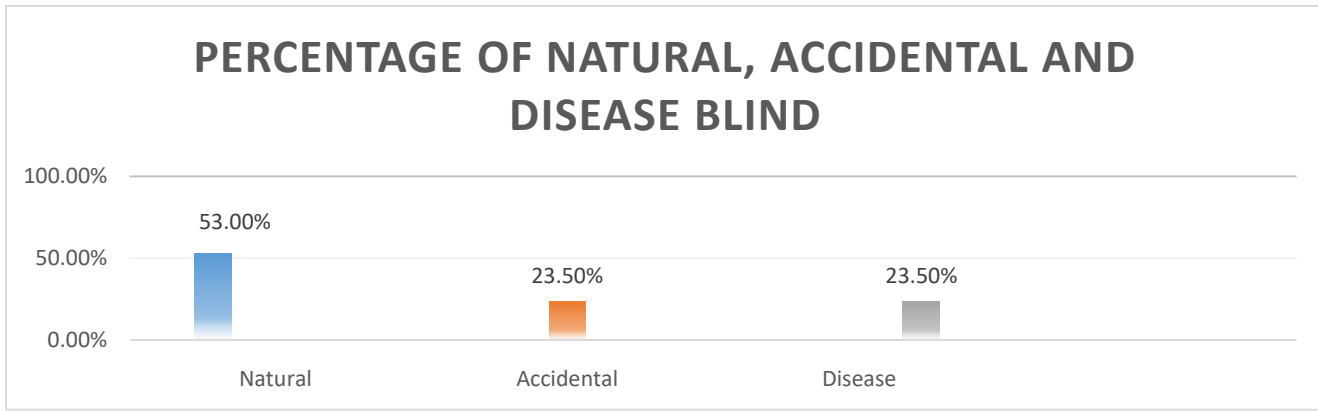
Percentage of Male and Female:
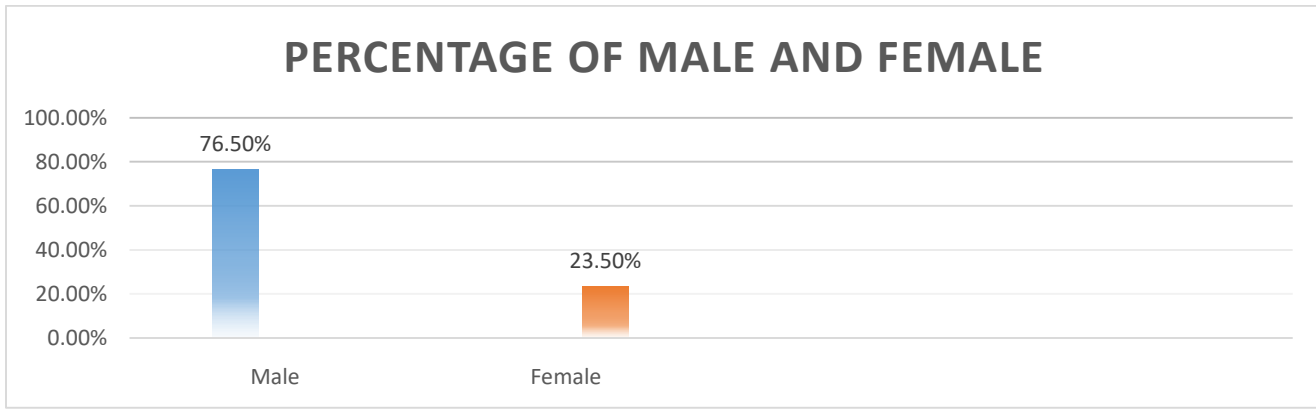
Figure 2.3: Percentage of Male and Female

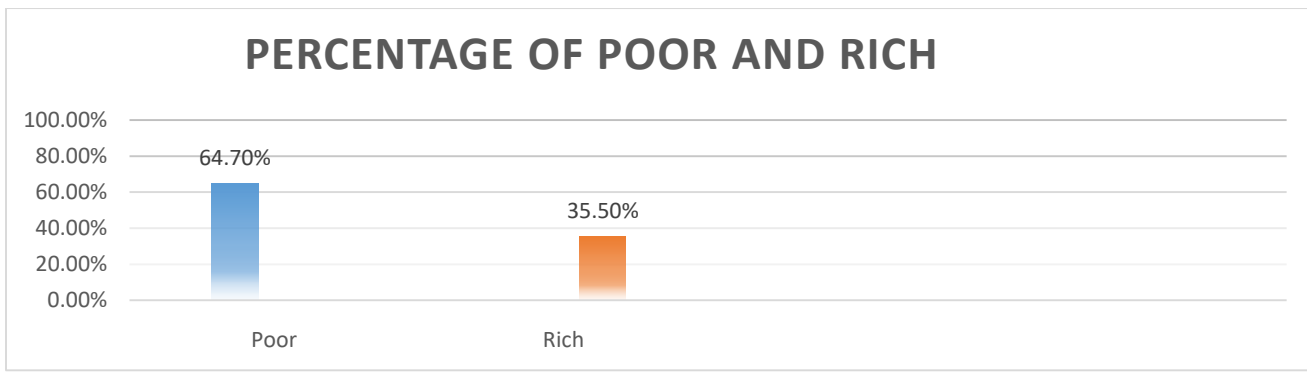**Percentage of dependent and independent:**

Figure 2.4: Percentage Dependent and Independent

Percentage of Natural, Accidental and Disease blind:

**Figure 2.5: Percentage of Natural, Accidental and
Disease blind**

3.2.5. Percentage of Poor and Rich:

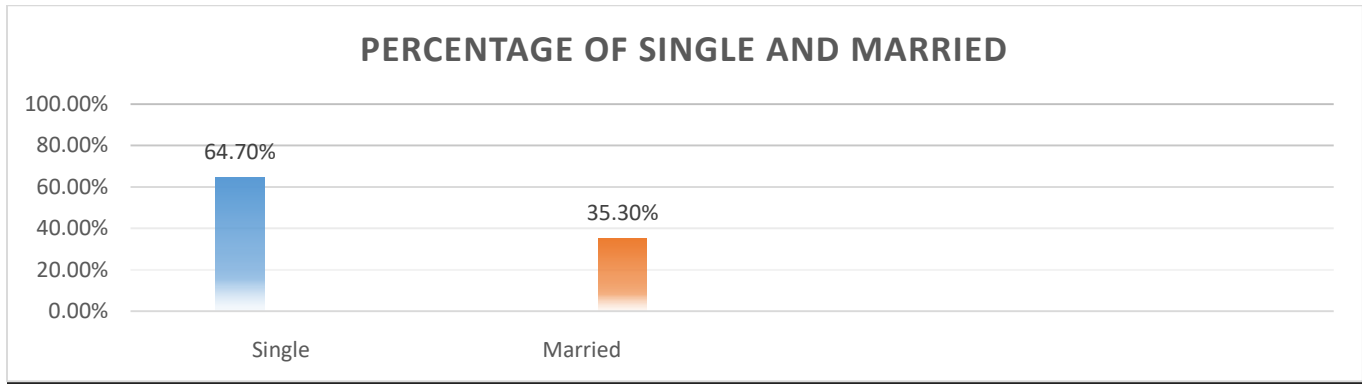**Figure 2.6: Percentage of Poor and Rich**

Percentage of Single and Married:

Figure 2.7: Percentage of Single and Married

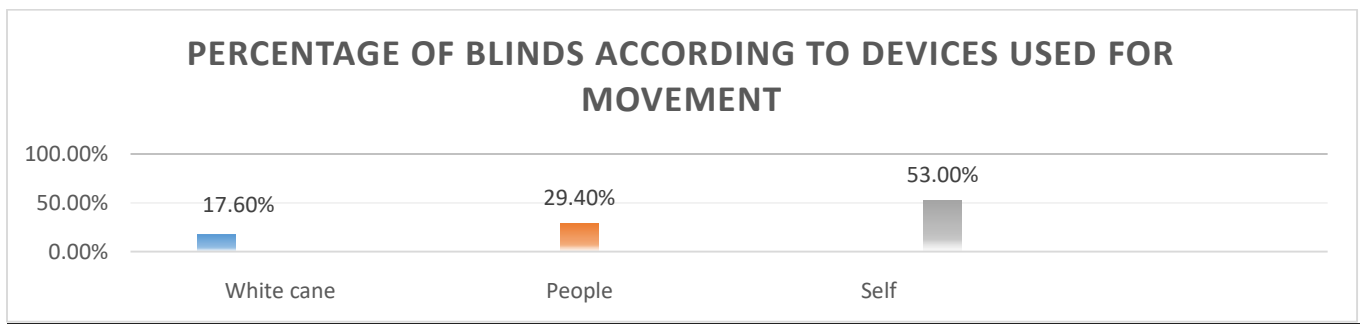**Percentage of Blind According to Devices used for Movement:**

**Figure 3.8: Percentage of Blind According to
Devices used for Movement**

Experimental Setup

The following materials are used in this project
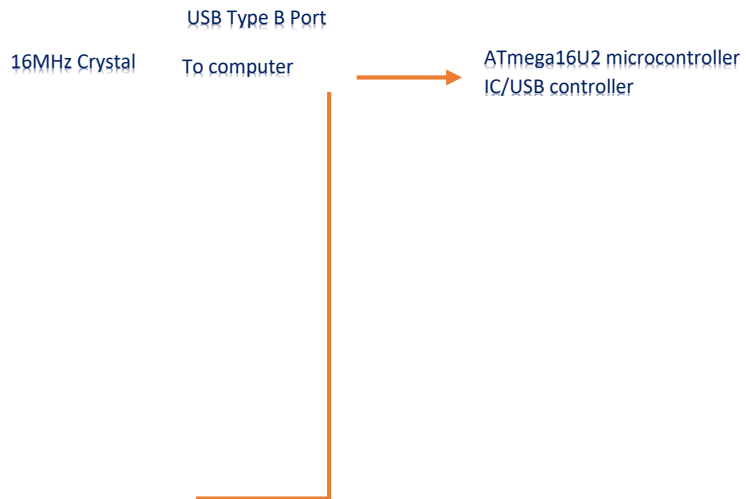
Bread Board:

A bread board is a thin plastic board used to hold electronic components. It is used to build and test circuits quickly before finalizing any kind of circuit. Bread board contain large number of holes in which the components like ICs, resistors, etc. are inserted. A common bread board is shown below:

Figure 3.9: Bread Board

rduino UNO:

One of the best and widely used Arduino is the Arduino UNO. UNO.Diagramatical representation of Arduino UNO given below.
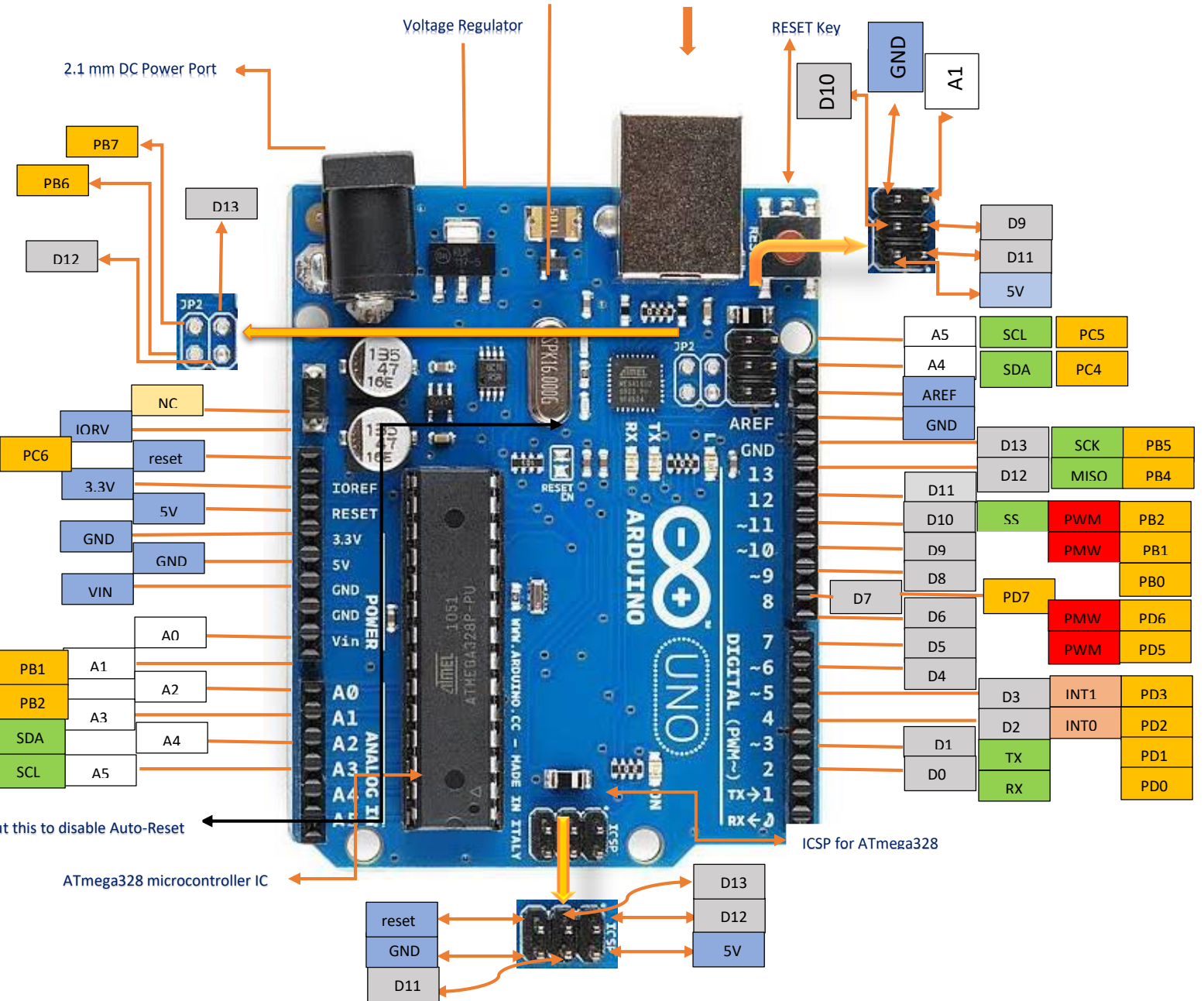
16MHz Crystal

USB Type B Port

To computer

ATmega16U2 microcontroller
IC/USB controller

Figure 3.11: Arduino UNO Component Daigram

Arduino Power Supply:

The Arduino UNO needs power supply for its operation and different ways are available for powering it. Mostly the board is connected to computer to give it power

Figure 3.13: 9V Arduino Power Supply

Buzzer:

It is an electronic component which produce sound. This sound will be used as an indication of alarm in our project. The higher or sharper sound indicate shorter distance and low sound indicate the long distance.
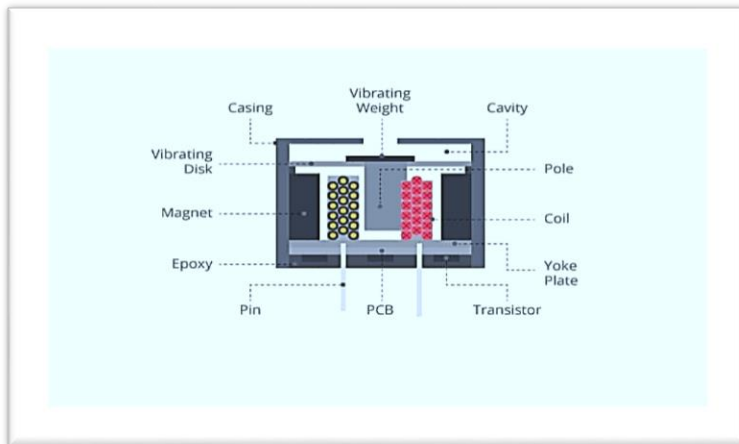

Figure 3.15: Magnetic Buzzer Structure

Jumper wires:

Jumper wires make the use of pins at the end to connect the different points in circuits without soldering.

. Types of Jumper Wires:

It has the following three types:

1. male-to-male,
2. male-to-female
3. Female-to-female.

Ultrasonic Sensor:

A non-contact device used for finding distance and velocity. Its working is based on the principle of reflection of sound waves having audible range greater than the human audible frequency range.

To furnish our project with the bat-powers we use a HC-SR04 Ultrasonic Distance Sensor that can state the reach of bodies up to (4m) away. It is cheap power, low in price, handy to interface with and as a plus point it even looks beautiful, like a couple of eyes for our venture.

RESULT AND DISCUSION

The survey results show that 17.6% of the participants use the white cane when going out alone. -53% of people did not use any obstacle detector in their familiar environment like schools, homes etc. Many obstacles are present in their path but mainly they face the collision with motorcycle and bicycle. Most of the participants urged that they had never used electronic travel aid but are very exciting as it will help them a lot. The low cost electronic detector were the interest of most participants.

Although we can detect large number of obstacle by our proposed model but it does not tells us about the type of obstacle, its orientation, shape, size and many more. Moreover, it detects the object only in the range of 1 meter to 1.5 meter in front.it also do not provide any safety regarding the upcoming obstacle instead it only detects the obstacle and then the blind person has to deal with it by itself.

CONCLOSION AND FUTURE WORK:

Conclusion

The conclusions deducted from the above study has two stages; one conclusion is from the survey that we have made and other is about the device and its prevelence. We will make bullet points to write these conclusions:

➢ The ratio of blind people in district Mardan is 0.049%.
➢ The percentage of literate and illiterate blinds in District Mardan is 29.4% and 70.6% respectively.
➢ Our survey related studies show that mostly the blind pedestrian's in district Mardan are poor and are mostly dependent on other.
➢ Mostly the people in district Mardan are blind Naturally.
➢ The severe accident they face is head strike.
➢ So in the light of above conclusions from the survey we made the following conclusions about our device
➢ The designed model is an obstacle detector for blind people using Arduino processor and ultrasonic sensor.
➢ The most important about this is that it is kept as low as possible in price but no compromise is made on the quality.

➢ It is made in such a way as to prevent the head strikes for which it is placed at the head's height.
➢ Alarm system is made as to make the blind aware either the obstacle is moving away or toward the blind.

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