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TechEye for Visually impaired using Internet of Things

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Abstract: Technologies and system adopted by laboratories and workplaces are turned too primitive to be operated upon. Experiment performed by using routine tools and equipment. Hand operated tools are just too much of energy and time taking whereas one which are automated are just too expensive. Using of these tools requires a great deal of knowledge to be gained and to operate without any loss and lessening the time consumption. But the need of the time is for the portable devices and tools which can be combined with different platforms like android. Along with meeting the requirement of time Arduino is an open sourceplatform. Arduino boardalong with Software Developing Kit (SDK) based programming used for interacting and commanding different sensors. Tools like this will attract and inspire a lot of young researchers and developer to aid with the crises in our society. We are using the same development platform to develop a device called as TECHEYE. And it is developed to help the blinds with their suffering and misery.

Keywords: Arduino, IoT (Internet of things), SDK, Arduino board, TECHEYE , Motion sensor, Piezo Buzzer

1. INTRODUCTION

Arduino was developed as a powerful electronic microcontroller [17] for the fast and easy prototyping and development tool contributing to the Internet of Things (IoT) [6][7]. One who wants to develop without the background of electronics and programming can easily operate upon this. It is an efficient brain for the projects.

According to the surveysINDIA HAS LARGEST BLIND POPULATION, as seen in the report by Times Of India, India is home to 15 million visually impaired from the world's 37 million a shown in Figure 1. As being the holder of the largest population of visually impaired, India is lacking the technology for the visually impaired. India requires 2.5 lakh of donated eyes every year of which only 25,000 are being collected [1].

Due to the shortage of optometrists and lack of money many visually impaired people happens to suffer a lot and some are so neglected that they tend to die within a road accident, due to this Helpline was Launched for Visually Impaired in India. To ease the life of a visually impaired, and to develop cheap and easy to use device called TechEye which give a close substitution to eyes with this Arduino platform along with its sensors [3]. Due

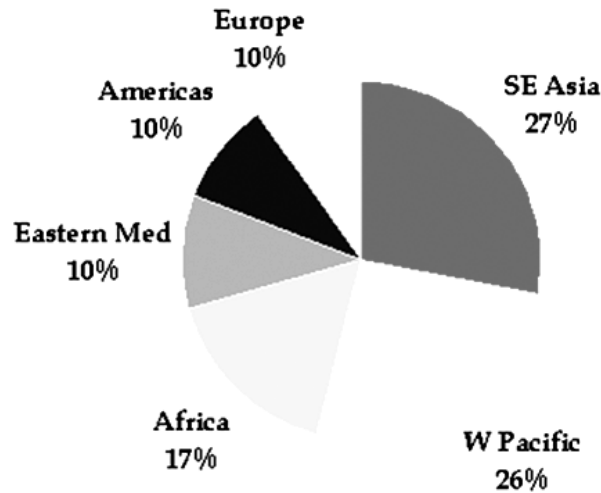


Figure 1: Global estimate of visual impairment by WHO region[15]



Figure 2: Helpline Launched For Visually Impaired In India [16]

to open source Arduino board copies are available at a very reasonable price making the TechEye easily approachable within the economic capabilities of all [5].

For the aid purpose combination of Arduino board along with Bluetooth module, IR sensor, smartphones, ultrasonic sensor etc. are combined together along with some programming on board [10]. This project not only help with making visually impaired person independent but also will avoid accidental death of a visually impaired person due to any hazardous household or on road article, making their life easy with the house automation and moving around without fear.

2. WHAT FOR VISUALLY IMPAIRED?

In article RISKS FOR BLIND PEDESTRIANS ON RISE (Dec 31, 2012, Adam Carey) [2], every time a visually impaired tries to travel outside of house in unknown condition it proves to be really unsafe as they turn out to be more prone to accidental injuries or even death. The only means of letting know the surrounding is sound and a physical stick which could take a lot of time scanning and in that time anything could come from the other side. In recent a vibrating stick is developed for the visually impaired, this stick vibrates whenever an irregular surface is being detected, but it will still take the same scanning time as well is very expensive and doesn't provide much information [11].

What our TechEye will help with is that the person will be aware of the surrounding comings and goings for every mili sec. As seen visually impaired have faster reflexes and can react much faster than an average human being, our TechEye not only cut off the time of scanning the surrounding through ears and stick but also make them more safe and make their movement time less hence reducing travelling time. On average estimation 1.4 million visually impaired children are below age 15 [12].

Where their life just started the live the life of constant fear of harms as because not being aware about what is around and sense of curiosity on peak which makes them to explore more and get caught in something that they don't have to. Devices that could tell them where to stop or has the whole control in hand could do as much as knowing they can use all the house facilities just by tapping or being automatic, having service in their own hand will reduce the chances of physical injuries by 80 to 90% as well giving the access to physical through network [13].

For every 100,000 required eye surgeon there is less than 1, where the parents leave the visually impaired child just after birth, where the roads rushes and the home is full of hazard chances of getting serious physical damage increases up to 89.65%[2]. Expenses of a normal impairment device is as high as getting a latest iPhone with less features and complex understanding but where TechEye can be developed in as less as 1 200 (with less features) and as high as 1 2,000 (with more features) [14].

People will be less interested if the facilities are less but price is more, but can compromise for low features at extremely low price. TechEye take only a minute to be learned, and will destroy the monopoly developed by the impairment devices maker [18].

Repairing and servicing is easy and not cost taking and can not only be used by visually impaired bit also for the care of infants, one who want control of his house in his hands or just for the safety measures can be used in hospitals, households, industries, schools etc.

3. ISSUES AND PROBLEMS

Suppose a visually impaired person happens to be sitting inside a room without any supervision of any person happens to feel uncomfortable from the inside temperature of room and want to turn ON/OFF air conditioner, or heater, or ceiling fan asking for help but no one is available and visually impaired person starts searching for remote by himself and fails to find it either he has to keep on suffering or he will try to approach switches and can get a shock if the approach is false which could cause serious health issues [19].

Commonly seen is with walking issues around the house being unaware about what is in front of them or touching something unknowingly which requires a special attention. Visually impaired person happens to touch a burning flame or a hot vessel in kitchen can cause high degree of burns, or hitting themselves with an object around them [20].

While walking on an unknown place like outside of house and not knowing what is coming, hitting legs on stones, some person in front of them, man holes where a stick fails to give the accurate information on time [22].

4. PROPOSED SOLUTION

To cope up with the problems and to reform the society of visually impaired this is an initiative project. These will help people by becoming one of their own body extensions [21].

The condition of hazardous object around the house (i.e. - hot vessels, iron or objects needing special handling care.

A battery powered Arduino with motion sensor, buzzer alarm and a small bulb connected to the bread board. This TechEye can be placed near the hazardous object where a visually impaired person should not go as

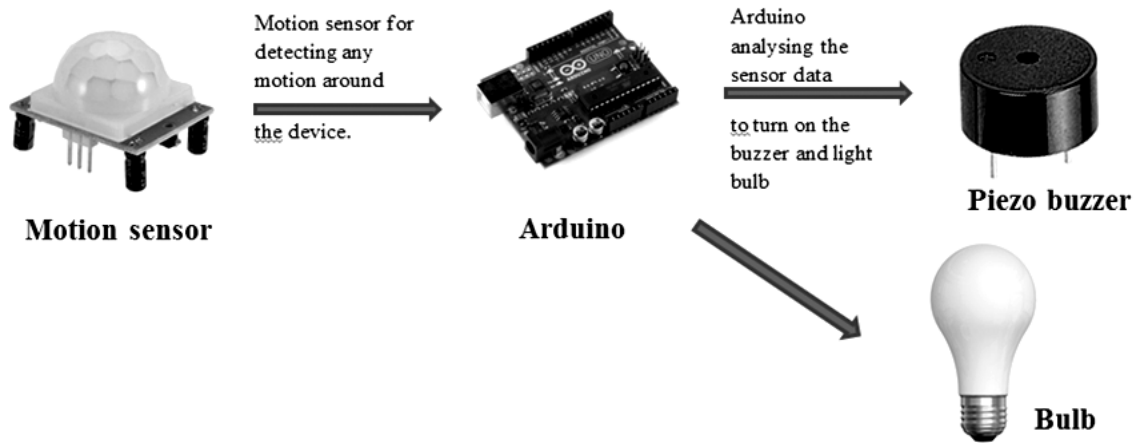


Figure 3: Hazards protection [16]

it can harm the person. Whenever a motion is detected (Figure-1) using motion sensor around the TechEye places near object the sensor send the analog data using output pin (other two pins are 5V pin and ground pin) to the programmed Arduino battery powered which analyse the data and send the specific high or low voltage to the buzzer (12V piezo buzzer, with one pin for ground and other for 5V) one as well as the light triggering them to start hence notifying the visually impaired as well as the other members of the household that the place is unsafe for being approached and the person will stop there and a family member could easily take the visually impaired person away from that specific object.

The condition of getting hit by the objects around the house or outside the house while walking and hence causing injury.

Ultrasonic sensor (5V pin, Ground pin and output pin)(distancevaries from 2 – 450 cm) is used to measure the distance between the TechEye and the obstacle and this property can help the visually impaired to move around without getting hurt. A bread board with Ultrasonic sensor grounded, powered and for receiving information

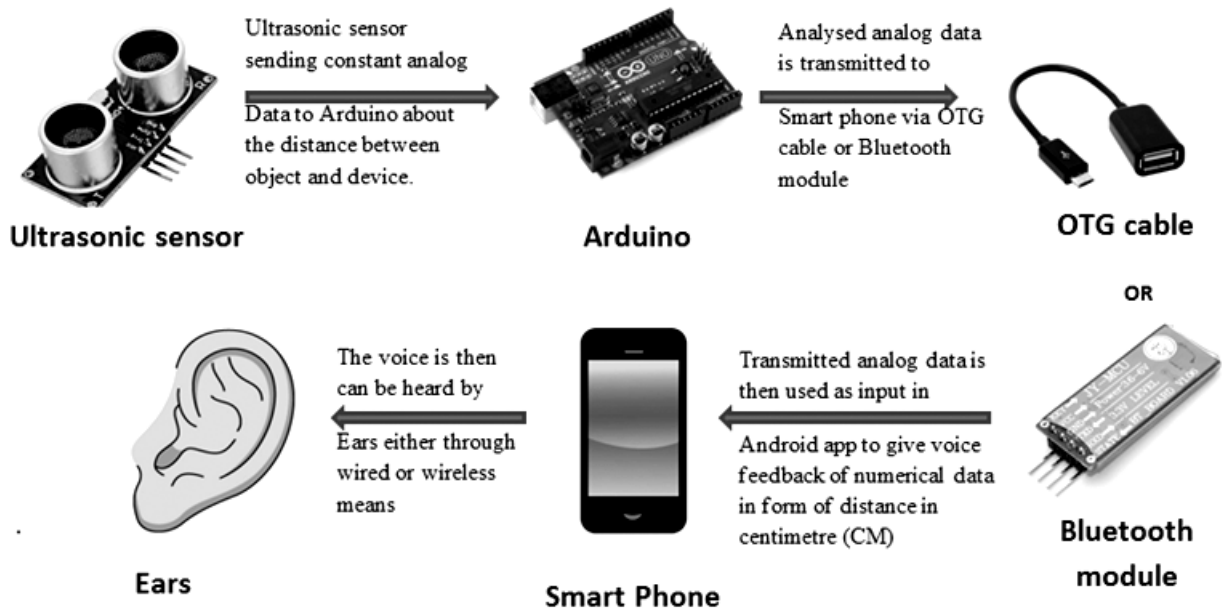


Figure 4: Walking System

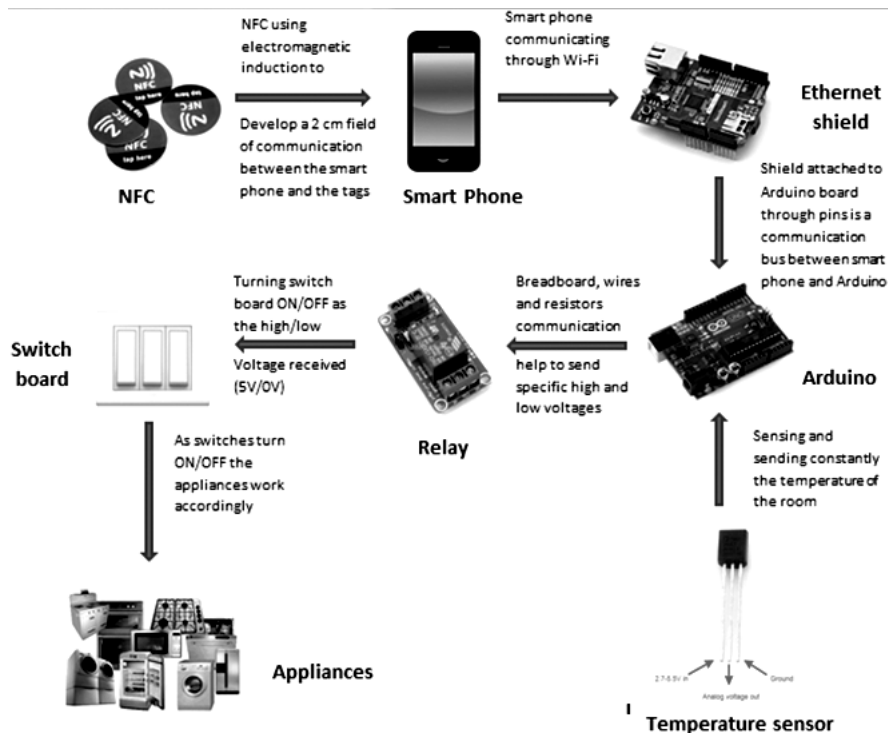


Figure 5: Automation

through jumper wires connected to Arduino ground, 5V and one of the pin (Figure-2). The Arduino is then connected to directly mobile phone power jack which provides power to the Arduino as well receives and de code and converts analog data from text-2-speech in centimeters [26]. The voice is then transferred from 3.5MM jack through heads phones giving the visually impaired person update about the obstacles distance from them in their path [27]. This TechEye could either be fitted on the stick or placed inside one of their shoes though which they can travel fast and more efficiently and can avoid any harm causing objects that could even leads to serious health issues [23].

The condition of temperature control inside the room to control and turn ON and OFF

As shown in Figure. 4 NFC(Near Field Communication)wrist bands or necklaces are used here and work as a portably available switch for the visually impaired people as whenever a smart phone is tapped upon an electrically information caring NFC it will command the Ethernet shield over WiFi using an android app running in background which further more send the list of commands to the Arduino and hence Arduino activates the whole system of TechEye [8]. A temperature sensor attached on a bread board on Ethernet shield constantly updated the Arduino about the temperature of the room [24]. In summers if the temperature of the room is more than the desired then the Arduino analyses the temperature analog reading and using it to send the specific high and low voltage to the relay (it has one pin for 5V, one for ground while the other are input pins connected to Arduino), if high voltage is received (i.e. - temperature is more than the desired) it turns ON the switch connected to the AC and for low voltage (i.e. - temperature is less then desired) it will turn ON the fan and hence turn OFF the AC, and in winters replacing the switch that of an AC with a heater [25]. Let us assume we set an ideal temperature at 27° Celsius and max temperature as 31°C [$^{\circ}\text{C}=(\text{voltage}-0.5)*100$] if the temperature sensed by the sensor is less then 27°C then heaterswitch connected to relay will supply voltage turning ON the heater connected relay and eventually turning ON the heater but just as the temperature rises more than 27°C the power source of relay connected to heater will sent (0) and hence turning OFF the heater and relay connected to the fan will send a (5) resulting in a upper voltage/peak and turning the fan ON but when the temperature further

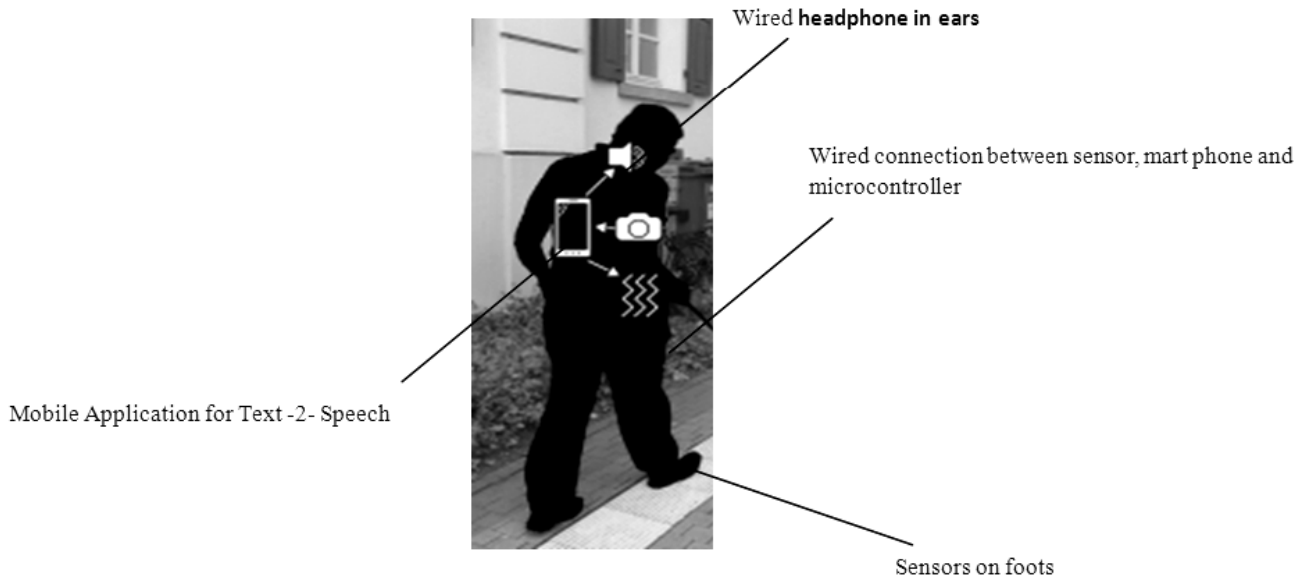


Figure 6: Components with description [28]

rises more than the high temperature i.e. 31°C this will send a (0) to fan relay and turning it OFF and (5) to the relay for the air conditioner resulting in turning ON the air conditioner [4][9].

5. ADVANTAGES

Table 1
Comparison of Current Technology with TechEye

S. No	Parameters	Current Technology	TechEye
1.	Availability	Availability of the technology is near to rare.	Can be provided even at local shops.
2.	Price	Relatively very high in price resulting in not being fit in the budget of the people.	Being ranging from ₹ 200-2000 results in being fit in everybody expenses.
3.	Features	Less features, usually working on ancient designs.	Using modern technology and giving more features at relatively very fewer prices.
4.	Designs	Have design of retro stick, Ex- vibrating stick, vibrates on irregular surface.	Can be given customised design, can be fitted in shoes or any likings.
5.	Mobility and independence	Mobility does not increase as much hence the independence	Increasing the moving speed hence increasing the individual independence.

6. Conclusion

With this TechEye we can not only reduce the injuries suffered by visually impaired, but also can give them the hope that people do think about them and soon make their life full of colours. Being not expensive at all almost everyone could use it. An expense of an injury treatment cause will cost more than the TechEye, so why not prevent before its coming as the wise says PREVENTION IS BETTER THAN CURE.

Along with being saving life it can also help in cost cutting by reducing the electricity consumption, as well an efficient way of saving time and making an individual independent.

TechEye can be used in blinds home where the number of service men is less, service charges are too high or men are just too careless.

Hence, we can easily conclude that TechEye will be proven to be helpful directly and indirectly to the human race.

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