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Presents

AAVISHKAR

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"The cover page image denotes the greatest human invention ever: The Wheel. It reminds us of how a simple idea has the power to change the whole world. Wheels and its forms are everywhere, from the tiny wrist watch to mighty aeroplanes."

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HUMAN FOLLOWING ROBOT (*" ANUGAMI "*)

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***Abstract*—The topic for Aavishkar was to design a robot which can follow a human automatically. The basic idea behind its implementation was to mainly use three technologies namely *bluetooth, mobile gps and mobile inbuilt magnetic sensors*. Firstly a wooden chassis was made on which different components like motors, motor drivers, bluetooth module, arduino, etc were mounted. An android app was developed using all these three technologies. The app was divided into three subapps- (a) Successfully connecting with the arduino i.e. robot via bluetooth (b) Extracting the coordinates and degrees rotated by the person every two second and processing these data and (c) Successfully sending these processed data back to the arduino. The bot is programmed such a way that it understands those sent data and follows the person carrying the mobile accordingly.**

I. Components Required

Table I
COMPONENTS USED IN THE ROBOT

Sr. No	Components used	Quantity
1	Arduino Uno	1
2	Breadboard/PCB board	1
3	Bluetooth Module (HC-05)	1
4	200rpm DC Motors	4
5	Motor Driver (L293D)	2
6	12V Lithium Polymer Battery (Li-po battery)	1
7	Power Bank (5V) (To power arduino)	1
8	An Android Mobile (with GPS connectivity)	1
9	Jumper Wires	Approx. 50
10	Arduino Cable	1
11	Tyres (Size according to chassis)	4
12	Human Following Robot (Android Application)	1
13	Glue Gun and Glue stick	1
14	Wood/Ply (To make chassis)	1

A. *Arduino Uno*

Arduino UNO board uses a variety of controllers and microprocessors. They are equipped with a number of analog and digital input output (I/O) pins. Arduino software is an open source software and the microcontrollers are programmed in basic C/C++ language. Even a basic idea of programming will suffice.

B. *Bluetooth Module*

HC-05 Bluetooth Module uses wireless serial connection setup. There are 4 pins in the module :

1) RXD : Connected with the Tx of the Arduino:

2) TXD : Connected with the Rx of the Arduino:

3) Vcc : Connected with the 5V for the supply power:

4) GND : Connected with the common ground of the Arduino:

C. *Android Studio*

Android Studio is an official IDE *(Integrated Development Environment)* for developing android applications.

It is based on *IntelliJ IDEA software*. It is compatible with Windows, macOS as well as Linux. The app is programmed in Java language.

D. *Global Positioning System*

GPS (Global Positioning System) is a satellite based *global positioning and navigation system*. The GPS satellities revolve around the earth in their specified orbits.

Each of the satellities transmit a signal and their orbital parameters which the GPS using devices decode and calculate the location of the sataellite. This information is used to calculate the user's exact location on the earth.

E. *Positon Sensor / Magnetic Sensor*

A *magnetometer* is a device which measures magnetism. the concept behind the sensor is to detect earth's magnetic fields. Position sensors are used with the combination of accelerometer to find the direction with reference to the north pole. Now a days every smartphones have inbuilt magnetometer sensor. All the mobile compass uses this technology.

These sensors are used to find the direction of a person.

Table II
FULL FORM OF *ANUGAMI*

A	:	Ascertain
N	:	New location
U	:	Using
G	:	GPS
A	:	And
M	:	Mobile
I	:	Inbuilt-Sensors

II. INTRODUCTION

As the name suggests "**ANUGAMI**" , the basic aim of the robot is to follow a particular person.

There are basically three technologies involved in this project : *Bluetooth*, *GPS (Global Positioning System)* and mobile inbuilt *Magnetometer sensor*.

The person which the bot needs to follow should have an android phone (*High-end*) with our app installed in it. Firstly the app will connect the phone with the bot via *Bluetooth* for the data transfer. Then it will use the *GPS in High Accuracy Mode* to find the position of the person in terms of latitiude and longitude every two seconds. This data is processed to find the distance moved. The degrees rotated is calculated using the mobile inbuilt *Magnetometer Sensor*.

Finally all these data are converted into a *single digit integer (0-8)* which is sent to the Arduino via blueotooth. The bot will move in a particular direction and in a particular degree accordingly.

III. CALCULATIONS

The main motive, is to calculate distance using latitude and longitude at each point. Initially the approach for finding the angle was, by using the bearing angle of the earth but due to large fluctuations we could not proceed.

Finally we came up with an idea to use inbuilt magneto sensor in the mobile which extract the angles directly.

A. *Distance*

To calculate distance we'll start with latitude and longitude. For traveling a distance between two points A and B, the android app will calculate the latitude and longitude at both points using GPS.

Now these values of latitude and longitude are converted into actual distance traveled by the person by using the formulas given below :-

where
$\triangle\lambda$: Difference of longitude between A and B
ϕ_1 : Latitude at point A
ϕ_1 : Latitude at point B
d : Actual distance traveled

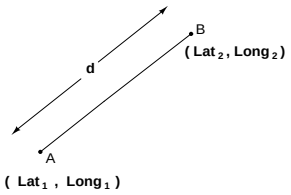

Figure 1. Figure representing how to calculate distance using latitude and longitude

R : Radius of earth
a : Radial Distance travelled

$$a = sin^2(\frac{\triangle\phi}{2}) + cos(\phi_1)cos(\phi_2)sin^2(\frac{\triangle\lambda}{2}) \quad (1)$$

$$c = 2.atan2(\sqrt{a}, \sqrt{1-a}) \quad (2)$$

$$d = R \times c \quad (3)$$

B. *Angle*

After calculating the distance, the objective is to calculate angle using magneto sensor. Similar to compass the magneto-sensor calculate the angle with respect to north direction.

Figure 2. Magneto-sensor used in the android application which is used in compass also

Using the magneto-sensors in the mobile, the android application will find the angle after every 2s. This data will be saved in the app.

After each refresh of coordinates and angle, the app will calculate the difference of initial angle and final angle and update the data. The angle calculated will be the actual angle, the person moved.

In the figure shown below, a person start from point O and travel to point A and then B. So from O to A angle moved with respect to north direction is θ_1 and from point A to B angle w.r.to north is θ_2.

So actual angle moved by the person from A to B is $\theta_2 - \theta_1$.

C. *Inaccuracy*

Even though the GPS is being used in *High Accuracy Mode* it is not 100 percent accurate. Because the GPS uses satellites for the transferring of data and the satellites revolve around the earth which is again rotating on its own axis, there would always be some inaccuracy in the location.

To tackle this problem one text field is added in the app for the user to enter the inaccuracy in centimeters.

Let's suppose a person is using this app and is standing at a particular place. The coordinate of that person on earth

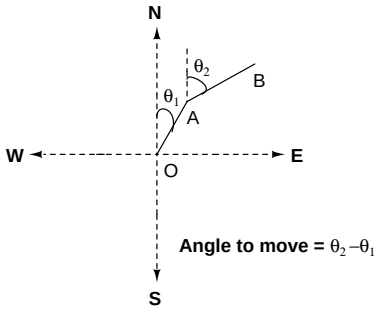

Figure 3. Figure showing how to calculate angle at each point

Figure 4. Screenshot of the android application main page

is constant hence the distance moved each secound should be zero. But that's not the case. There would be a slight fluctuation in the distance say 25cm in average.

So the user can enter say 30 in the field given. This inaccuracy will be then nullified. That means the robot will move only if the distance calculated is more than 30cm.

D. ***Conversion***

The distance moved and the degrees rotated each second is already calculated. Now these data needs to be processed and converted into an easier form which can further be sent to the arduino. So basically a *single digit integer value* would be sent to the arduino via bluetooth ranging from 0 to 8.

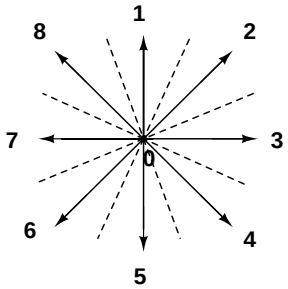

Figure 5. Figure representing the conversion of data into 0-8 digits

The command = 0 would be sent when the person is standing at a constant place i.e. *when the distance is less than inaccuracy*. Otherwise integer values from 1-8 would be sent according to the information given in the following table:

Table III
CONVERSION OF DATA WHICH IS TO BE SEND

Sr. No	Change in angle (in degrees)	Command sent
1	-22.5 to 22.5	1
2	22.5 to 67.5	2
3	67.5 to 112.5	3
4	112.5 to 157.5	4
5	-157.5 to 157.5	5
6	-157.5 to -112.5	6
7	-112.5 to -67.5	7
8	-67.5 to -22.5	8

IV. RESULTS

Following are some photographs (Fig. 6) and a screenshot (Fig. 7) taken during the execution of the project.

(a) (b)

Figure 6. Pics of the BOT taken from different angles

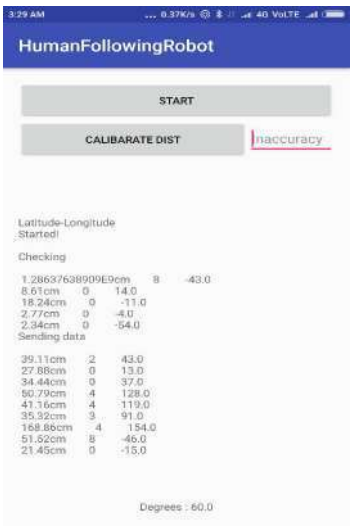

Figure 7. Screenshot of the android application in use

V. DISCUSSIONS

The Fig. 6 is the photograph of the robot. Here the Power is given to all the four motors by a single *12V Lithium-Ion-Polymer* battery. The Power to the brain of the robot, Arduino is given by a *10000mAh Power-Bank (5V)*.

The Fig. 7 is the screenshot taken from the app running during the execution of the project. This is the second and the main page of the app. The first page was for the connection of the bluetooth. In this Figure the data are divided into two segments i.e. **Checking** and **Sending Data** and each into three columns which represents the *Distance moved (in centimeters)* by the person, the *command (0-8)* sent to the Arduino and the last column for the *degrees rotated* each time.

The *Checking* segment is just for a trial. It manipulates the *Inaccuracy* enterted by the user. Beacuse at the starting the fluctuation in the distance is large, it needs some time to cool down. This problem is tackled by this segment which puts some delay before sending the data to the Arduino.

The *Sending Data* is main segment where the actual command *(Column II)* is sent to the Arduino. The Arduino is programmed accordingly to make the bot follow the person using the sent data.

VI. Motivatin of the project

There are many uses in many aspects in the world related to the product. Some of them are given below :-

A. ***Social Uses***

1) Can be used to *lift heavy loads* at Bus stands , Railway stations.
2) Help the farmers to *collect the Harvest*.
3) Can help nurses and compounders in *hospitals* in case of emergency.

B. ***Daily Uses***

1) Could assist Parents with small children by getting his/her location.
2) Mopping the floors in house and also carry clothes after washing/drying which will help housewives to work easily.

C. ***Other Uses***

1) Helps in laying down new roads by carrying mortar and spreading it onto the unpaved road (Indirectly help the workers to do the job quickly).
2) Can be attached to a trolley in high rated shopping malls to automatically follow a customer during shopping.
3) Helps waiters in hotels/restaurants to carry too many food items at a time and room service equipment.
4) It can act as a lawnmower to cut the grass automatically.
5) Can be used for *Spying Purpose* in remote areas.

VII. Prerequisites

Here are some prerequisites that one should have before using this Human Following Robot:

1) Beacuse its an android app one should have an **android phone**.
2) Because the GPS is being used in **High Accuracy Mode** the smartphone should be **High-End**. It consumes a lots of power and performance therefore the phone should have high RAM, fast processor, etc.
3) **High speed internet** is preferred for fast functioning of the GPS.
4) Should be performed in an **open enviornment** and not inside the room. The signal would suffer from a lot of reflections before getting into the phone GPS and hence the received signal would be very much disturbed.

VIII. Conclusions

It is concluded that the robot made is much more efficient than the existing bots in many aspects as given below.

Some modifications can be made to make the robot more human friendly. First is by installing a GPS module in the robot itself. It increases the accuracy even more. The data would be extracted at a faster rate. Secondly, the simple tyres can be replaced by caterpiller track which makes the movement of the robot easier in sandy, snow and in extreme path.

There are many companies which have already developed a human following robot but they all use either Image Processing ,Ultrasonic Sensors or IR Sensors. The use of bluetooth and GPS is new and unique to follow a particular person and much effective than using Ultrasonic/IR sensors.

IR sensors work on the principle of sending and receiving waves continuously and whenever they get the reflected wave the bot will start to move. But the main drawback in this concept is that whenever any person crosses the way in between then bot starts to follow that person which is not required.

In the bluetooth module the bot is encrypted and connected to the bluetooth to a particular person only.

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Alpha: The Interactive Robot

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***Abstract*—The objective of the project is to design a multi-purpose voice-controlled interactive robot. It can interact with the user by speaking out its replies. It can move around and pick up objects. It is also a mode of entertainment, learning and information. When bored, the user can talk with it and also play music. It has a game which can teach children to read. Thus, another objective is to display the versitility of such robots.The result of the project is the robot Alpha which fulfils the objectives.**

I. Introduction

In the recent years, the topic of human-robot interaction has drawn a lot of attention [1]. As the use of robots are increasing, their numbers around us is also increasing . So the interaction between the robots and human has become very important. One of the best ways to interact would be voice. A robot that can listen and speak would make it easier to be used. Further, this feature makes a robot more human-like companion. Such robots are already used in areas likes Autism therapy [1].

The objective of the project is to build the prototype of a versatile robot with special emphasis on speech recognition and synthesis. The result is the robot- Alpha. The robot is based on Arduino Mega 2560 micro-controller board. In the later sections the construction and working of the robot is explained.

TABLE I
Apparatus used

Apparatus	Quantity
Arduino Mega 2560	1
Arduino Uno	1
HC-05 Bluetooth module	1
DHT-11 sensor	1
LM386 amplifier	1
9g Servo motors	2
500rpm DC motors	2
4 ohm Speaker	1
L293D motor driver	1
bread board	3
9 volt DC supply	1
16x2 LCD Display	1
Resistors	10
Capacitors	5
Potentiometer	1

II. Description of the components used

- **Arduino Mega [2] :** It is a microcontroller board based on ATmega1280. It has 54 digital input/output pins and 16 analog inputs. In the project, it is used as the main controller.
- **Arduino Uno [3] :** It is also a micro-controller board based on ATmega328P. It has 14 digital input/output pins and 6 analog input pins. It is used to control speech production.
- **Bluetooth Module(HC-05) [4] :** The bluetooth module is used to connect the Mega micro-controller to the phone through which input is gathered.
- **Temperature and Humidity sensor(DHT11) [5] :** The DHT 11 is a temperature and humidity sensor. To calculate humidity, the resistance between two electrodes with a moisture holding material between them is considered. As the moisture content changes, the resistance also changes. To measure the temperature, it uses a thermistor. The device works for the temperature range of 0-50° Celsius with 2° Celsius of accuracy. It senses humidity in the range of 20% to 80%. The sampling rate is 1 kHz.
- **DC motors and Motor driver(L293D) [6] :** The micro-controller sends signals to the DC motors(500 rpm) via a L293D motor driver to provide the necessary power to the motors.
- **Servo motors:** The servo motors are used in the arm. These motors work with pulse width modulation [7]. The angle of the shaft of the motors is contorlled.
- **LM386 audio amplifier [8] :** The output of the Uno board is not strong enough to be able to feed to the speaker. So the signal is amplified by using the LM386 amplifier IC with the circuit shown in Fig. 3.
- **LCD [9] :** The prototype includes a 16x2 blue LCD to display the output [10].

Fig. 1. Bluetooth Module [4]

Fig. 2. Temperature and Humidity Sensor [5]

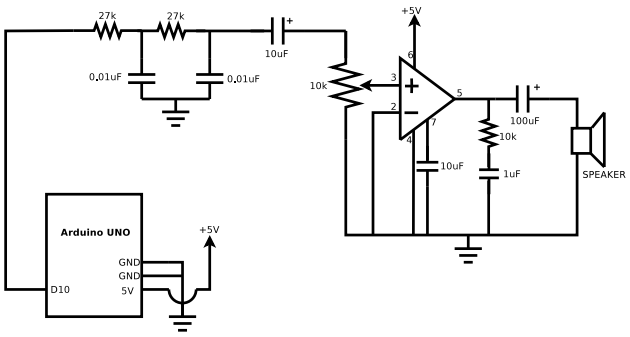

Fig. 3. The circuit for the the amplifier [11]

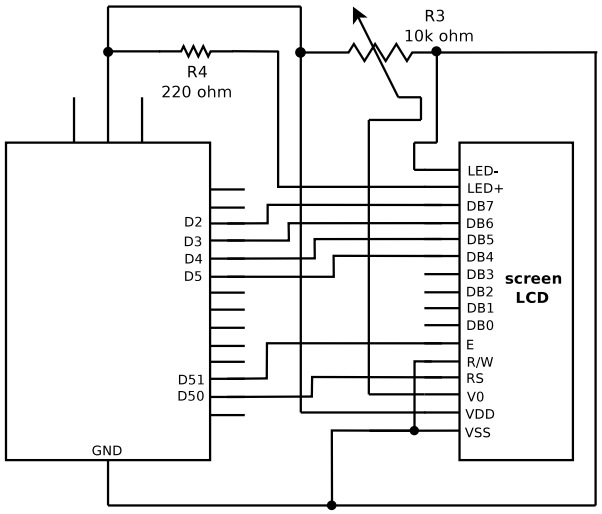

Fig. 4. The circuit for the LCD [10]

III. Design and Working

The main circuit for the robot shown in Fig. 6 and Fig. 7. The structure of the robot is depicted in the images Fig. 9 and Fig. 10. Fig. 5 shows the flowchart for the implementation of the design. The user feeds input using the Alpha Controller app (Subsection IV-D). The app connects to the robot via Bluetooth. The user speaks the command and the app sends the commands as strings to the Arduino Mega which processes the command to take the necessary action. If necessary, it takes in the input from the sensors attached and computes the output. The Mega controller then passes a command to the Uno controller which feeds the signals to the speaker via the amplifier circuit. Thus, the output is produced through the speaker. Furthermore, the Mega board also controls the LCD to display some of the outputs.

The codes are written on the Arduino IDE [12].

The Mega and the Uno micro-controller connection is via I2C connection (Subsection IV-B). The SCL and SDA(refer section IV-B) pins of two boards are connected. The Mega is the master which controls the output of the Uno board. The Uno board is used because the speech synthesis uses the Talkie Library which works only on ATmega168/328 boards like Uno and not on Mega.

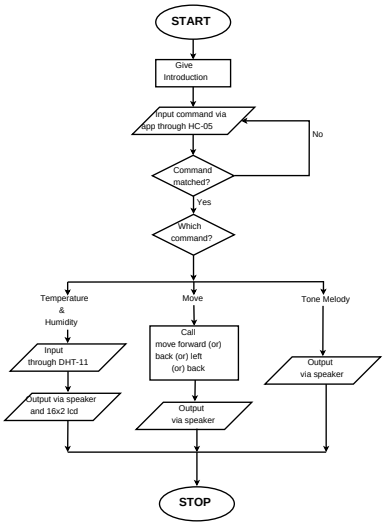

Fig. 5. Flow Chart for the implementation of design

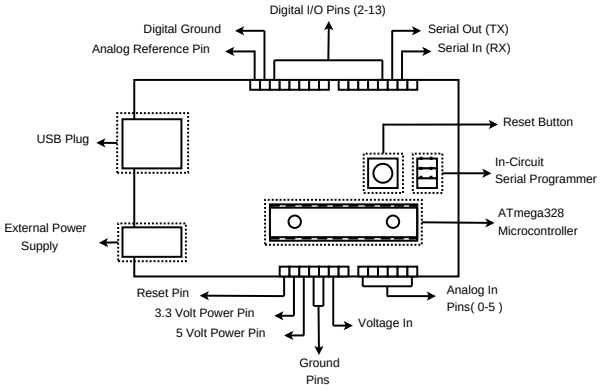

Fig. 6. The connections with the UNO board

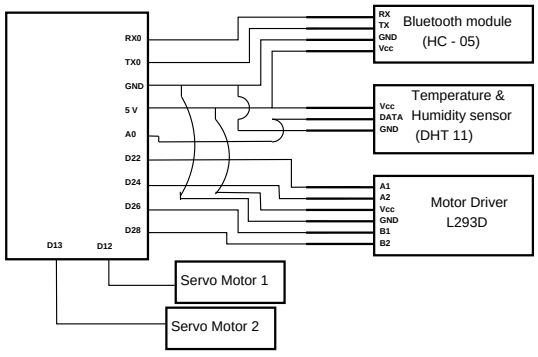

Fig. 7. The Connections for the Mega board

A. The Talkie Library [13]

The Talkie library is a software implementation of the Texas Instruments speech synthesis architecture(Linear

Predictive Coding) [13] . This library has a collection of over 1000 words. This library works with a amplifying circuit and does not use any text-to-speech hardware.

B. I2C Connection [14]

I2C or intra- integrated circuit is a serial computer bus which uses the Serial Data Line(SDL) and Serial Clock Line(SCL) to communicate among the boards. In our project, the UNO is receiving data using this connection.

C. The Spelling Game

This simple game involves the LCD. It displays a word on the LCD. The user should read it out. The robot provides feedback accordingly . It can teach the children to read correctly.

D. The Alpha Controller

The robot takes voice command through a mobile phone. It uses an Android app for this. The app, Alpha Controller (Fig. 8 shows the user-interface of the app) is made using App Inventor for Android provided by Google [15] and maintained by Massachusetts Institute of Technology. The app converts the speech to text using Google API. The strings are then passed on to the Mega board through a bluetooth connection. It also has some control keys to facilitate console control.

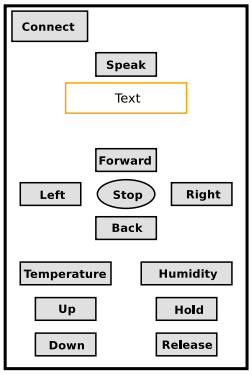

Fig. 8. User-interface of the Alpha Controller

E. Commands and Control:

The following are the some of the commands to control the robot:

TABLE II
COMMANDS

Command	Output
move forward/move/forward	Moves forward and speaks out that it is moving ahead
right	Moves right and speaks out that it is moving right
move back/back	Moves Back and speaks out that it is moving back
left	Moves left and speaks out that it is moving left
up	moves the arm up
down	moves the arm down
hold	holds the object
release	releases the object
remember path/path	starts remembering its path until it is asked to return
return	returns along the remembered path
what is the temperature/temperature	speaks out the temperature and also displays it on the LCD
what is the humidity/humidity	speaks out the humidity and also displays it on the LCD
sum followed by the two integers (positive only)	displays and speaks out their sum
play music	plays music
set alarm followed by the time	sets alarm
teach	opens the spelling game
any common question used in normal conversation like hi, what is your name and so on	replies to the question

IV. RESULTS

The result is the prototype of a robot which can do the following tasks:

- Move Around
- Pick up objects
- Tell temperature and humidity
- Do simple mathematical operations
- Play music
- Train to read
- Set alarm
- Talk with user
- Remember path

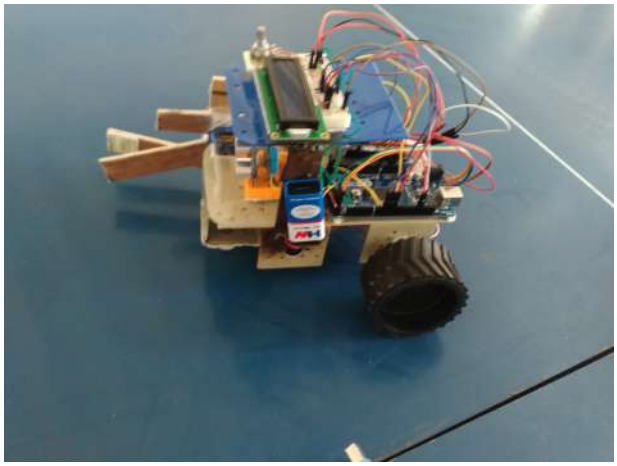

Fig. 9. Alpha

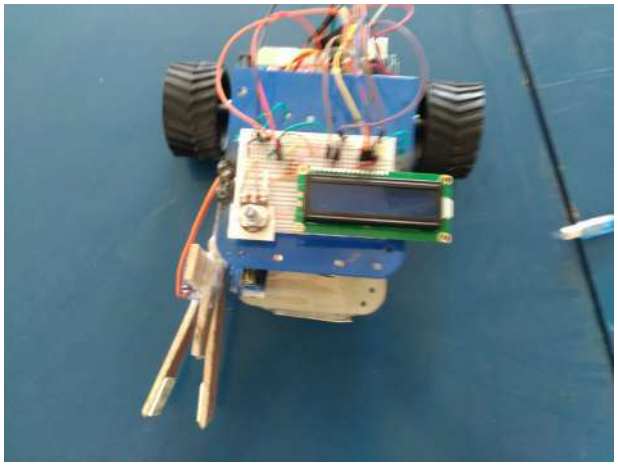

Fig. 10. Alpha

V. Conclusions

We proposed to build a versatile robot that can interact through speech. The results show that the objective was completed.

The project was a great learning experience. We were able to build a prototype which can demonstrate the versatility of tasks such a robot can conduct.

Most of the actions were hard-coded in it. But an interesting future task might involve introduction of the techniques of machine learning to it, which would make it more useful and autonomous . Further, a better controller like Raspberry pi could be used.

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Advanced Version Of Collision Detection Unit Aavishkar 2017

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***Abstract*—The project AVOCODU (Advanced Version Of COllision Detection Unit) aims to bring some important high-end safety features to low end cars at significantly low costs. Features implemented in AVOCODU include collision detection and warning while driving, blind spot detection, prevention of drunk driving, gear change assist and communication to family and friends in case of any mishappening.**

Fig. 1. AVOCODU and the Team

I. Introduction to Avocodu

These days it is very essential to learn driving. But the busy roads, even in the morning, make it difficult for beginners to learn. They often end up hitting something with their vehicles. It's very difficult for them at beginning to decide on which gear should the car be driven. This gear problem is even faced by experienced drivers if they shift from a plain lying area to some hilly area or vice versa.

In order to solve these problems and assist drivers, this product is useful. Here is a brief introduction of what the product can do.

In case, the car is about to hit into an obstacle in the front and the driver doesn't apply the brakes in time, this gadget will slow the car down and when the collision is imminent, it will stop the vehicle. Similarly, during lane change, presence of a blind spot prevents the car from turning and push it forward instead. An alcohol sensor used in the car will allow it to start only if the driver blows into it and alcohol levels are found to be less than the legally permissible. The same features are highlighted in more detail in the trailing sections.

The following sections contain detailed description about

II. Gear Suggestion

Talking of introducing features to make drivers comfortable, one feature primarily targeted at new driving learners or the people new to the terrain e.g., a person from plains moving to hills or from hills to plains.

This can act as a way to suggest gears to the driver. If the driver has already put a gear, then they can verify if they used the correct gear. And if they are completely clueless, then they can use the suggested gear.

On simple research, we observed that change of gear depends on the inclination of the path, desired or possible speed of the vehicle, the torque of motors, the surface of the road and a few other factors [1].

The two primary factors found to be involved are speed and inclination. Due to budget constraints, we used motors which could not provide us with the speed, hence we kept suggestions based only on the inclination of the vehicle. As a thumb rule, lower inclination implies higher gear and vice versa.

To get the inclination of the vehicle we use the InvenSense MPU-6050 6-axis inertia measurement unit.

A. The InvenSense MPU-6050

The InvenSense MPU-6050 sensor contains a MEMS accelerometer and a MEMS gyro in a single chip. It is very accurate, as it contains 16-bits analog to digital conversion hardware for each channel. Therefore it captures the x, y, and z channel at the same time. The sensor uses the I2C-bus to interface with the Arduino. The MPU-6050 is not expensive, especially given the fact that it combines both an accelerometer and a gyro. The sensor has a "Digital Motion Processor" (DMP), also called a "Digital Motion Processing Unit". This DMP can be programmed with firmware and is able to do complex calculations with the sensor values.
This device communicates with the Arduino board using a I2C bus. This acts as a slave device to the microprocessor. This device can be connected to more device in which case the MPU-6050 will act as master device for it.[2]

III. The Buzzer Alert System

A major chunk of accidents take place due to distracted driving and fatigue. In both the scenarios, the driver's alertness is reduced.

"Distracted driving" is driving while doing something else that reduces attention towards the road. Activities like eating,

talking on the phone, listening to music, texting or even using the GPS built in the car can distract the driver and endanger the driver and others. In 2013, 424,000 people were injured in motor vehicle crashes involving a distracted driver, an almost 10% increase since 2011.[3]

Countries have made rules to reduce use of phone and texting but their effectiveness has been very low.

Lack of sleep leads to fatigue which can reduce driver's alertness. Sleep deprivation increases the risk of crash related accidents. The less the driver had sleep, the greater is the risk. There is no test to determine sleepiness as there is for intoxication, i.e. like a "Breathalyzer". A study by researchers in Australia showed that being awake for 18 hours produced an impairment equal to a blood alcohol concentration (BAC) of .05, and .10 after 24 hours(.08 is considered legally drunk).[4]

A buzzer alert system can alert the driver of incoming vehicles, objects, and give sufficient time to the driver to react and prevent accidents. In this project, piezo-electric buzzer was used to alert for incoming objects. The buzzer gave different sounds depending on the distance of the object using the input given by the ultrasonic sensors.

IV. Alcohol Detection

Consuming alcohol in even small quantities causes decline in visual and mental functions. Higher dosage can cause reduced coordination, deteriorated muscle movement and poor information processing capabilities. Thus, intoxicated drivers are prone to be involved in accidents.

The "Alcohol Detection Unit" aims to reduce the number of road accidents caused by drivers under influence. There are primary two components in this unit : the MQ3 Alcohol Gas Sensor and SIM800C GSM Unit[Sec. V] The alcohol sensor can be placed on the dashboard or at the either side of the driver's seat so that the alcohol levels of the driver can be monitored easily.

When the driver tries to start the car and if his alcohol levels are higher than the legal levels, the car will not start. If the driver persistently tries to start the car, the buzzer will go off, attracting the attention of the nearby people. Additionally, a message will be sent to the relatives and the guardians of the driver via the GSM Unit, informing them of the driver's state.

If the drivers get drunk while driving, the alcohol sensor will slow down the car gradually, so that the driver can park it at the roadside safely. [5]

A. MQ3 Alcohol Gas Sensor

The MQ3 alcohol gas sensor gives analog value corresponding to the alcohol content of the air. The readings are generated within 2 seconds and pretty accurate. Thus MQ3 sensor is ideal for usage as a breath-analyzer. MQ3 uses a layer of Tin Dioxide (SnO_2) to detect the prescence of alcohol. In clean air, the conductance of SnO_2 is low, but as alcohol comes in contact with SnO_2, it converts into the respective acid, which has higher conductivity than the clean air. Thus MQ3 sensor gives its reading based on the changing conductivity levels of the SnO_2 layer. The sensitivity of the unit can be changed using a potentiometer.

Apart of alcohol, the MQ3 sensor also has a small response for benzene and gasoline. The MQ3 sensor also requires preheating time of approximately 20 minutes before usage in order to get stable values. This is because the above reaction requires heat.

There are lot of MQ3 unit types and each has its own load resistance. Thus individual units need to tested and calibrated for the precise trigger point. Through experimentation, the reading of 280 of the MQ3 analog was finalized as the trigger point. Overall, MQ3 gives accurate and reliable readings quickly and is relatively cheap. Thus it was considered appropriate for this project. [6]

V. GSM communication system

GSM stands for Global System for Mobile Communication and is the most widely used system for mobile communication. GSM operates at various frequency channels, but the GSM Unit SIM800 operates at 900MHz or 1800Mhz.

Using the SIM800 unit, we can get the all functionalities of a mobile phone including sending and receiving SMS and phone calls. The SIM800 unit requires a 2G SIM for its functioning, which needs to properly calibrated and registered. GSM Units use a set of commands called the AT commands, for setup, control and transmission. Here's the summary of a few AT commands that we used to setup this unit.

The AT command that we deployed to alert the relatives/guardians of the driver was AT+CMGS.[7]

$AT + CMGS =< number >< CR >< message >< CTRL - Z >$

VI. Algorithms

All the below algorithms are implemented based on the readings of the 6 sonars. 4 of these sonars are placed on the four corners and the remaining 2 are placed on the front and the back.

A. Collision Detection Assist

A huge problem that new drivers face is that they fail to judge the nearest neighbour distance for the vehicles around them are (mostly because of the fact that the steering wheel is placed on one side).

The aim of the collision detection assist is to alert the driver is case a collision is imminent. The algorithm primarily takes two things into consideration:

1) How far are the other vehicles from the driver's vehicle (Distance)
2) How fast is the driver approaching the surrounding vehicles (Relative velocity)

$$Relative\,Velocity = \frac{Current\ Distance - Previous\ Distance}{Time\ gap\ between\ the\ readings}$$

Note : The relative velocity is measured by subtracting the current and previous distances measured by the sonar and then dividing the result by the amount of time it took the loop to execute

This algorithm accounts for 5 major cases:

1) There are no surrounding vehicles. In this state, nothing happens. This could be the case when the driver is on a highway or is driving between two cities, etc.
2) There is atleast one vehicle in the vicinity of the driver but the driver isn't approaching the vehicle at an alarming speed. In this case also, no alerts are shown.
3) There is atleast one vehicle in the vicinity of the driver and the driver is approaching it at a very fast pace. (i.e The speed of the driver's car relative to the other vehicle is very high). In this case, a buzzer starts beeping. This is to notify the driver to reduce his/her speed.
4) The driver's vehicle is really close to a surrounding vehicle and there still exists a negative relative velocity between both the vehicles. In this case, the buzzer starts beeping (this time, the beeping pattern and the frequency of the beep is different). This is to notify the user to immediately stop the car and maintain a safe distance from the other vehicle.
5) The driver's vehicle is really close to a surrounding vehicle but the relative velocity is almost zero. In this case, nothing happens. This could be the case when the driver is driving in traffic.

B. Parking Assist

The parking assist is mostly similar to the collision detection assist. There is a parking switch on the remote, which when pressed will call a function to change the distance and relative velocity thresholds. This is done because the minimum allowable distances are obviously different in case of normal driving and in case of parking. Apart from this, the remaining part of the algorithm is mostly same as Art. VI-A.

C. Lane Change Assist

A lot of road accidents take place simply due to the negligence of the driver when he/she is trying to change lanes but doesn't notice a vehicle travelling on that lane at a pretty high speed and still tries to turn. The aim of the lane change assist is to try and prevent a collision in such cases by intimating the driver about this beforehand.

The lane change assist mainly takes into consideration the 4 sensors on the corners of the car. In order to understand the working of the algorithm, consider the following situation:
The driver is trying to move towards the left lane but there is a car diagonally opposite to ours on the left side. Please consider the sonar at the bottom left corner. Now there are two cases:

1) The distance isn't decreasing between both the cars. In this case, it is safe to turn (If there is a safe distance between the two cars).
2) The distance is decreasing : This means that the other car is already in a position where it is impossible for the car to turn. In this case, the buzzer starts beeping. If the driver doesn't respond quickly enough, the lane change assist will automatically apply mild brakes (given there is no vehicle directly behind ours) and prevent the collision.

TABLE I
MAPPED FORWARD VALUES

Y Axis	forward
4 to 505	100 to 0
525 to 1020	0 to -100

TABLE II
MAPPED TURN VALUES

X Axis	turn
4 to 505	-100 to 0
525 to 1020	0 to 100

VII. THE REMOTE CONTROL OF THE DEMO MODEL CAR

A. Bluetooth

Bluetooth Remote Control: The car used for demonstration purpose is controlled using a bluetooth remote control requiring one extra arduino (mega or uno) board (other than one already placed onto the car chassis), two bluetooth modules (HC-05 used for this project) and connecting wires. Pairing only occurs between two bluetooth modules if and only if one of them is master and the other is slave. AT commands are used for controlling the Master/Slave behaviour of HC-05. By default, all HC-05 modules are in Slave configuration. Two Bluetooth HC-05 modules are used such that one is connected with an arduino (mega) board further connected to a Joystick (acting as remote-control) in Master configuration (AT+ROLE=1) and the other one is connected to the arduino board of the car in the default Slave (AT+ROLE=0) configuration (there's absolutely no issue doing it other way round).

B. The Joystick Based Control

The axes vary from 0 to 1023 where the centre rest position for the joystick is around (512, 512). The Y axis was chosen to control the forward and backward movement of the car, while the x axis controlled turning of the car.

According to the orientation of the joystick that was chosen, the 0 on the Y axis represented a full throttle towards front, and 1023 the exact opposite. . The 0 on the X axis represented left and 1023 towards right. The value of the Y axis was stored in forward and the x axis was stored in turn.

It was decided to leave a little margin of error for the rest position. On the Y axis, 4-505 was selected as forward, and 525-1020 was selected as backward. Doing this gave us various levels of speed. For X axis 0-505 was selected as left and 525-1020 as right.

To disable rotation at one place, any region on the joystick that had a higher magnitude for turn that forward, was modified for interpretation. Wherever the magnitude of forward was lesser than the magnitude of turn, its magnitude was raised to the magnitude of turn, while maintaining its original sign.

In order to communicate the three values: parking state, forward, and turn with the remote effectively and quickly,

a method was developed. It involved to send a 10-character string to the car in each packet of data sent to the car.

The first character was made to represent the parking state. It was either 0 or 1. The next character represented the sign of the value of forward. 1 for negative and 0 for positive. The next 3 characters represented the absolute value of forward. 0100 for 100 and 1100 for -100. The next character represented the sign of the value of turn. 1 for negative and 0 for positive. The next 3 characters represented the absolute value of turn. 0100 for 100 and 1100 for -100. The last character was chosen to be '\n'. This actually represents newline. This was chosen to act as a trigger to the decoder to begin interpreting the string. The interpreting of this string was done at the car using a simple algorithm. First of all, the input string was converted to a 9-digit number. The data type unsigned long on the Arduino was a good selection for this. Using modulo operator, a reminder for a particular operand can be found, the numbers are decoded. In this way, the car is able to interpret 3 values: parking state, forward, and turn.

The function Steer(): The function Steer accepts 2 values, namely, forward and turn, both in the range of 100 to 100. Since PWM pins were used to control the speed of the motors on left and right, it was identified that selecting 2 variables left and right (whose values would be calculated using forward and turn) would be appropriate. The value of left was calculated as the sum of forward and turn. The value of right was calculated as the difference of forward and turn. This logic came up by trial and error. To ease calculation, the 2 values left and right were constrained to be in the range -100 to 100. Later on, their absolute values were scaled from 0 to 255. This value was then fed into the respective PWM pin for the motor, where 0 meant rest, and 255 meant rotation at full speed.

Associated with each motor are 2 Digital pins that help in controlling direction of rotation of the motor. When one of the pins is high, and the other is low, it will rotate in one direction. When the polarities are reversed, the direction of rotation of the motor is also reversed.

VIII. Conclusion and Future Possibilities

At the end of the project, the following features in the model were working: [The model was controlled with a joystick]

1) The buzzer beeped based on relative velocity and distance triggered collision detection assist, lane change assist and parking assist units.
2) Brakes were automatically applied if collision is imminent.
3) The alcohol detection unit detected alcohol above a particular threshold and sent a SMS to the preset phone number.
4) The gear suggestion system displayed the appropriate gear on the seven segment dispaly. For the model, we assumed the speed to be linearly proportional to motor input voltage because it was not possible to use a tachometer due to budget limitations.

We achieve nearly 100% of our expectations. The responsiveness of the unit was exemplary. The algorithm also handled basic and most common exceptions or corner cases that arise in practical situations. Also, if this is made a marketable product, it would be very easy to play out appropriate pre-recorded audio messages using a speaker instead a simple beep. This audio playback was not required in this simple model.

TABLE III
Equipment Price List

Motors x 4	760	HC-05 x 2	618
Motor drivers x 2	380	Wheels x 4	100
Chassis	220	Seven segment x 2	20
Wires	360	Dual axis joystick	149
MPU6050	229	SIM800C GSM module	620
MQ-3 Sensor	219	Arduino Mega2560 x 2	1498
Buzzer	90	Sonars x 8	872
Breadboard	70	Li-Ion battery	600

Total budget : Rs. 6805.

The budget spent on the essential modules(collison detection, parking assist, lane change assist, gear suggest and alcohol sensing) was Rs. 3699 while the rest of the amount was for building a model to demonstrate the working of the system.

Driving is something that every one of us mostly does some stage or the other. Self driving cars available in the market are not available in India, and the ones avilable in developed countries are not affordable by anyone but the very rich. It will probably take a decade for them to be available to commoners. Since with driving there naturally comes the risk of accidents we think that a product like this, which does not aim to completely take over the driving task but merely assists the driver by adding an extra layer of safety would be a significantly useful product.

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Self Balancing Platform: Aavishkar' 17

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***Abstract*—In the project, we built a Platform with the objective of making it Self Balancing so that it can remain parallel to the ground at any point of time. The motive of the project is to prevent the objects placed on the platform from falling or shaking. We started the project with making the base of the project. Then we made the algorithm for the same and wrote the code by uisng various libraries. All the electrical connections were made thereafter. Then, the platform was constructed and connected to the base of the servo motors. This project finds various applications in social life.**

I. APPARATUS REQUIRED

- Arduino UNO R3 ATmega328P : 1
- Servo Motors : 2
- DFRobot FPV Nylon Pan Tilt Kit : 1
- Accelerometer and Gyroscope (MPU6050 Module) : 1
- Breadboard : 1
- Connecting wires(Male to Male) : 11

II. INTRODUCTION

The Self Balancing Platform is an Electro-Mechanical system which is used to balance the objects and prevent them from falling when placed on the Platform. These kind of Platforms run on Accelrometer and Gyroscope sensors. This machine has a column like structure with $13X13X23\ cm^3$ dimensions. This machine could be used in preventing tremors, shakes and vibrations. The Platform balances itself by rotating in the direction opposite to that of the base by the same angle with the help of Servo Motors. These kind of machines could be useful in tackling the problem of motion sickness too.

A. Motivation

We got inpiration for our project, after encountering a patient in an ambulance not laying comfortably on the strecher in hilly areas. Quite a lot of people also suffer from motion sickness while travelling in a vehicle. So, in order to resolve all these problems, we thought of making a device which is insensitive to shaking and moving base. That was the moment when we decided to work upon this social health issue so that we can have an impact on the society even though on a small level. The secondary source of motivation was technical. We were intrigued by the mechanism of an Accelerometer and its property of measuring acceleration.

All these things, be it social or technical summed up together motivated and pushed us to take up the project and thus leaving a small imprint ont the society.

B. Accelerometer and Gyroscope

The Accelerometer and Gyroscope chip used in the project is based on Micro-Electro-Mechannical-System(MEMS) technology. The Gyroscope is used for measuring the angle of rotation. This Gyroscope has a Micro Oscillator which oscillates and thus is used for detecting acceleration which in turn measures direction change. This information is then processed to measure the angle of rotation.
The Accelerometer on the other hand is used for measuring the translational acceleration. A small mass is suspended at the centre of the chip by four beams. When the chip is displaced the mass produces stress in the four beams. The beams are doped with Piezo-Electric material and this stress causes a change in the resistance of the Piezo-electric material. This change produces an electrical signal which is in correspondence with the mechanical acceleration of the chip.

Fig. 1. Accelerometer and Gyroscope MPU-6050.

C. *Arduino*

Arduino is an open source platform which designs and manufactures Micro-Processors and Micro-Controllers. The Arduino UNO board contains a variety of pins for analog and digital Input/Output. The Arduino Board can be programmed using an extended dialect of C and C++ computer languages. The Arduino is an intelligent circuitary which when programmed could be used for performing various tasks as required. The Arduino is basically used for building devices that can interact with the environment by the use of Sensors and Actuators. Some of the Examples of these kind of devices are Robots, thermostats, Motion Detectors etc.

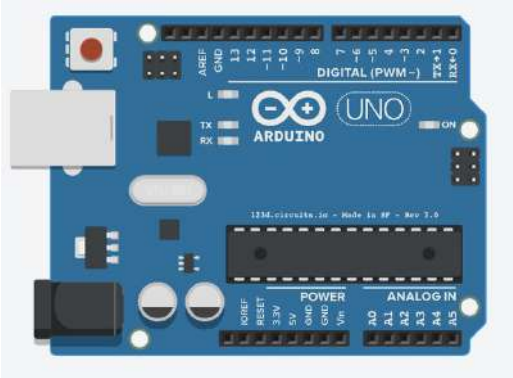

Fig. 2. Arduino UNO.

D. *SERVO MOTORS*

A Servo Motor is an Actutator which is used for controlling position, velocity or acceleration. Servo Motors work on closed loop mechanism. They use position feedback to control its motion and final position. It makes use of an encoder to provide position and speed feedback. The Encoder measure the speed of the output shaft and a variable speed drive to regulate speed long with PID algorithm which makes the movement of the motor more precise.

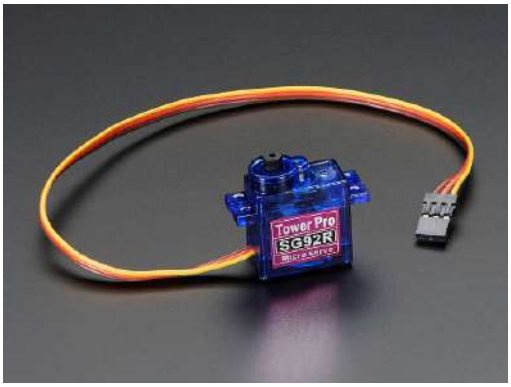

Fig. 3. Servo Motor.

III. PROCEDURE

- Firstly, we came up with the algorithm to balance the Platform so that it can maintain horizontal level.
- Then we converted the Algorithm into the actual code using the Arduino IDE Software.
- Then we started making the body of the machine. We moulded a metal sheet into a U-shaped sheet which was mounted on a wooden plank. This completed the base of the machine.
- The Pan-Tilt-Kit was assembled and the two Servo Motors were mounted on it accordingly for their rotation about x and y-axis.
- We connected the accelerometer to the Arduino to get the information processed according to the code. The Arduino Output was connected to the Servo Motors through male to male wires.
- Then we built a small Platform out of a wooden plank.
- After that we mounted the Pan-Tilt-Kit on the base using nuts and bolts. Then we mounted the Platform on the Pan-Tilt-Kit and thus completed the Mechanical Work.
- Offsets were added to the coded to calibrate motion of the Platform.
- This calibration was the final step towards completion of our Project.

IV. IMAGES OF THE PLATFORM

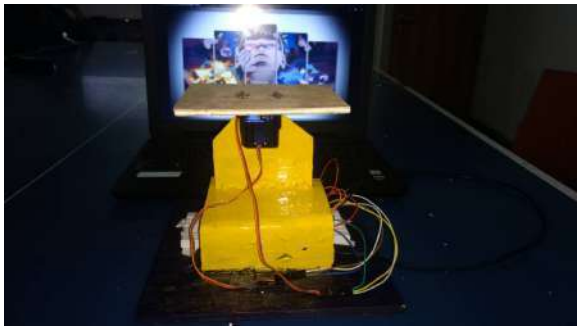

Fig. 4. The Platform.

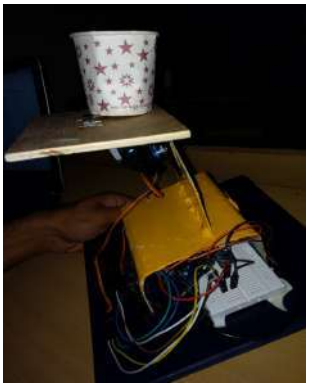

Fig. 5. The Platform in stabilising mode.

V. ALGORITHM USED

The Arduino was programmed to keep track of the accelerometer + gyroscope orientation and control the motors to keep this orientation as desired (parallel to the ground).
The accelerometer communicates with the Arduino using the I2C protocol. The motors are controlled by sending serial data as digital input to control the direction moved by the motors. The basic algorithm applied involves the movement of the motors by an angle of x degrees in their respective axes for a movement of +x by the base (or gyroscope).

VI. LIBRARIES USED

- MPU6050.h contains functions to control and read values from the accelerometer/gyroscope.
- Wire.h allows communication of Arduino with I2C devices (here MPU6050)
- Servo.h contains functions to control servo motors.
- I2Cdev.h contains collection of well defined classes to provide simple interface with I2C devices.

VII. THE CIRCUIT

- Firstly, we made the connection of MPU6050 with arduino.
- V_{cc} was connected to 5V, GND was connected to GND of Arduino Uno, SCL was connected to A5 and SDA was connected to A4 of Arduino.
- Then, the connections of servo motors with Arduino Uno were made.
- Black wire of both the motors were connected to GND, red of both the wires were connected to 5V and yellow wire of one motor was connected to D9 and of other motor was connected to D10.
- Aruino was provided with external power. We connected it with a laptop for the same.

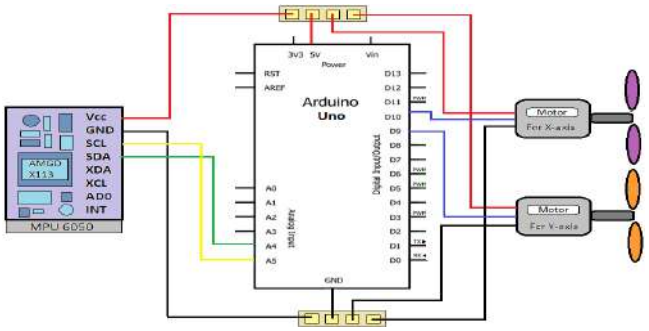

Fig. 6. The Circuit diagram of Project.

VIII. CHALLENGES FACED

- The first challenge that we faced was the calibration of the x and y axis co-ordinates between the Arduino and the Accelerometer.
- Synchronization of tilt angle with the 16 bit data of the accelerometer and gyroscope.
- The final challenge was the calibration of servo motor angles for finer movement and balancing.

IX. RESULT AND DICUSSIONS

- The platform balances any object placed on it. The object does not suffer any acceleration in the x and y direction.
- The maximum mass that can be balanced on the platform depends on the capacity of the motors. For the motors used, it was 1kg.
- To prevent overload a delay of 50ms was introduced. Thus the lag in the platform was almost zero.
- The budget of the project is Rs. 2,350 while the alotted budget was Rs. 4,500.

A. *APPLICATIONS*

- These kind of platforms can be used by the defence agencies to stabilize the Tanker Guns and Sniper Rifles for better aiming.
- These platforms are also used in Segways and other auto-balancing Vehicles.
- These platforms can help patients suffering from Parkinsons Disease (causes tremors and shaking in hands) in carrying objects.
- A more improved and strong prototype can be theoretically used to stabilise buildings during earthquakes.
- It can also be used to stabilise the carrier on which the patient lays in ambulance.
- It can also be used in Wildlife photography when the camera is mounted on a vehicle.
- It also fisnds an application in Airplanes and Trains for waiters and vendors to carry food items and beverages.

B. *THINGS WE LEARNT*

- We learnt basic functioning of Arduino, Gyroscope and Accelerometer.

- We learnt about the circuit connections and studied about various pins of the devices.
- We also learnt to assemble servo motors in Pan Tilt Kit.
- We also learnt importance of calliberation .

X. CONCLUSIONS

- The Arduino seemlesly reads and proceses data from the devices.
- The platform found various uses in social life, medical and military purposes.
- The platform is able to balance objects for a tilt angle between -85 to +85 degrees.

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Money Utilization through Digitalization in Remote Areas (MUDRA).

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***Abstract*—The project MUDRA basically aims at providing to the people, a different mode of digital transaction. Uniquely, this mode doesn't depend on the availabilty of internet connectivity unlike the prevalent existing digital transaction methods. Hence, it would enable one to have the the advantages of both : (a) the paper currency and (b) the digital wallet. The money transfer device (named MUDRA) does not require a third party server to exchange the information or the data. For the transaction to get completed, it simply requires the payer to swipe his/her device onto the device of the payee. Keeping in mind the prospect of *Digital India* as well as the current internet access scenario in remote areas, the project has immense potential to hit the grounds.**

I. Introduction

MUDRA is a device which uses the serial communication properties of an Arduino , in order to transmit and receive the data, which is basically, the net amount to be transferred.

A. The components

The major components which are used for making the device, are briefly discussed here :

1. Arduino : Arduino is a system that uses ATMega 328 as its microcontroller (a system that serves as the center of all systems and regulates all activities of the input/output system). Arduino consists of an Arduino Board as hardware part and an IDE (Integrated Development Environment) that used C-like as its software language. [1]

The Arduino Nano is a small, complete, and breadboard-friendly board based on the ATmega328 (Arduino Nano 3.x). It has more or less the same functionality of the Arduino Duemilanove, but in a different package. It lacks only a DC power jack, and works with a Mini-B USB cable instead of a standard one. [2] [3]

2. Keypad : Matrix keypads use a combination of four rows and four columns to provide button states to the host device, typically a microcontroller (in this case, Arduino). Underneath each key is a pushbutton, with one end connected to one row, and the other end connected to one column.

In order for the Arduino to determine which button is pressed, it first needs to pull each of the four columns (pins 1-4) either low or high one at a time, and then poll the states of the four rows (pins 5-8). Depending on the states of the columns, the Arduino can tell which button is pressed. [4]

(a) An Arduino Nano. [5]

(b) A Matrix Keypad. [6]

(c) A 16x2 LCD. [7]

(d) A Li-Po battery. [8]

Fig. 1: **Major components used in the making of device.**

3. LCD Display : LCD (Liquid Crystal Display) screen is an electronic display module and find a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special and even custom characters (unlike in seven segments), animations and so on.

A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. [9] [10]

4. Li-Po Polymer Rechargeable Battery : Lithium Polymer batteries, are a newer type of battery, now used in many consumer electronics devices. They have been gaining popularity in the radio control industry over the last few years, and are now the most popular choice for anyone looking for long run times and high power. [11]

For the project, two such batteries per device proved to be sufficient enough.

B. Motivation behind the Idea

The motivation behind our idea lies in achieving the following :

1. Financial Inclusion, which is the delivery of financial services at affordable costs to sections of disadvantaged and low-income segments of the society.

2. Digitalization of cash in remote areas : The solutions existing in the mobile network regions are not very user-friendly, especially for the users in rural areas.

3. Removing Network Requirement : We aim to remove the dependancy on any kind of network connectivity, be it internet or be it mobile, for enabling the digital transactions.

Moreover, the name MUDRA itself draws its motivation from the Hindi word *mudrā* (IAST)[1] , which means currency.

C. Target Audience

Though the project basically aims at providing a digital mode of transaction to the people from remote/rural areas, it is not only limited to them.

Initially, the system can be implemented on a small scale viz. a college campus or a township , and later on, if feasible, throughout the country.

D. Conversion of Digital Money into Cash

Since the project is currently at the prototype level, the currency conversion feature has not been implemented yet. But it can be implemented by either of the following two ways :

Method-1 : The users go to authorised kiosks set up across borders and transfer cash into their MUDRA wallets. This is very much similar to the mobile recharge process and hence is quite easy for the rural people to pick up on.

Method-2 : An alternate approach to the currency conversion feature can be to have tie-ups with the banks. This again, is a method which is not complex for the people from the remote areas to understand.

II. Implementation of MUDRA

A. Making of the device

To demonstrate the working of the device, two identical sets were made.

1. First of all, the code to be fed into the Arduino was drafted and stored in the device. The pseudo code for PAY MODE is shown in Fig. 2 :

```
Read key value
if pressed key is pay key
        ask to enter the amount
                read key values
                if key pressed is cancel
                        cancel transaction and return to initial mode
                if key pressed is some number
                        remember as input money
                if key pressed is clear
                        clear the input money and initialise money input
                if key pressed is 'ok'
                |       ask for passowrd
                |       get the password value from eprom
                |       if password do not match
                |               print incorrect password
                |               cancel transaction and return to initial mo
                |       if password matches
                |               wait to receive the 'ready' signal from
                                another machine through Rx pin
                |       if other machine sends 'ready'
                |               start sending the input amount signal
                                through Tx pin
                |               wait to recieve the 'confirmation'
```

(a) First half of the code.

```
                |               wait to recieve the 'confirmation'
                                signal from another machine through
                                Rx pin
                |               if confirmation received
                |                       deduct input amount from eprom
                |                       save the transaction to
                                        eprom's transaction space
                |                       print success message
                |                       return to initial mode
                |               if any key pressed
                |                       if key pressed is cancel
                |                                       cancel the transaction
                                                        and return to initial mode
                |       if any key pressed
                |               if key pressed is cancel
                |                       cancel the transaction and return to
                                        initial mode
                |
                end if

end if
```

(b) Second half of the code.

Fig. 2: **Pseudo code, when the user selects Pay Mode.**

2. Next, the LCD Display was connected to the Arduino board. Subsequently, the keypad was connected to the same.

3. All the components were soldered onto a PCB [2] and wires were connected according to the circuit design.

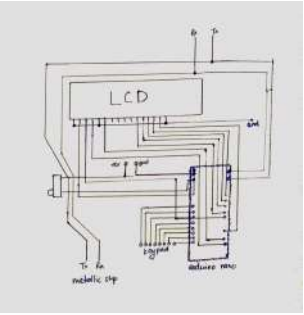


Fig. 3: **The circuit showing the connection of Arduino pins with the LCD.**

4. Finally, the case of the device was made by cutting a PCB into the required shape. Chart paper was used to cover the casing.

[1] International Alphabet of Sanskrit Transliteration

[2] Printed Circuit Board

Fig. 4: **(a) The device on the top of the image shows the rear side. (b) The device at the bottom of the image displays the front side, with MUDRA being displayed on the screen.**

B. Working Principle of the Device

1) For storing the balance and transactions: In order to store the current balance available in the device and the details of last 5 transactions, we used the EPROM [3] of the Arduino.

An Arduino Nano has 1 kilobyte of EPROM, which is sufficient enough to store this amount of data.

2) For transferring the amount from one device to the other: TX and RX pins of the Arduino are used for tansmitting the data. One byte of data can be sent through the TX pin of arduino of one device and can be received through the RX pin of arduino of the other device. Since a 'char' data type consumes one byte, a maximum of 255 (the cross check number of characters in one byte) can be sent through the TX pin at one time. A sample conversion of 301 INR to string of characters and then back to the amount is shown below :

$$301 \rightarrow 100+100+101 \rightarrow [d, d, e] \rightarrow 100+100+101 \rightarrow 301$$

Hence, to send the amount through the TX pin, we had to break the amount into small numbers between 0 and 255. Next, we converted these small numbers into characters and stored them in an array as a string. On the receiver's end, the arduino receives the data byte-by-byte until the whole array is not received. The array of these characters is first converted into the small numbers, which are then added to obtain the net amount.

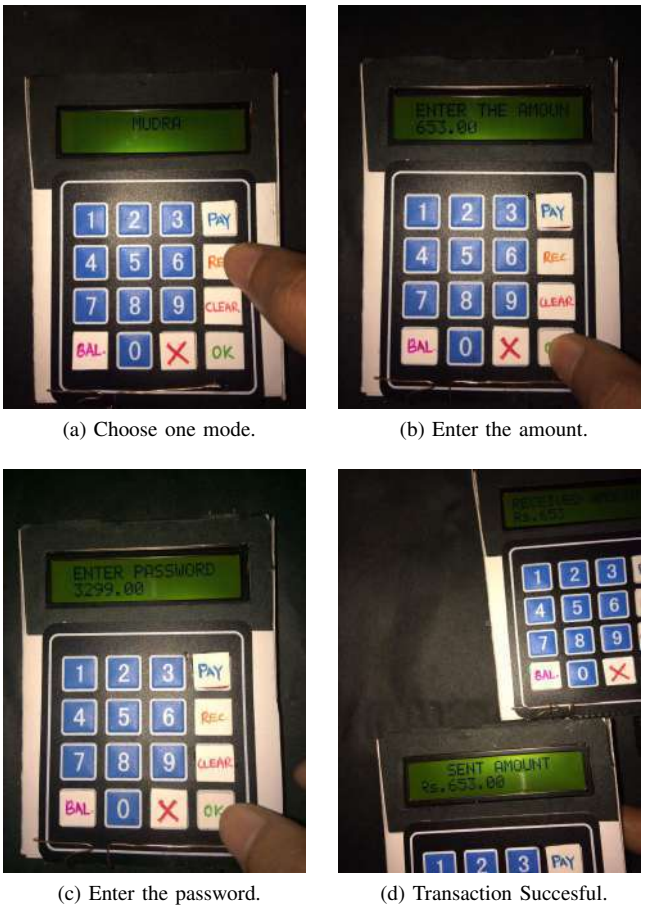
C. How to Use.

The transaction gets completed in four simple steps :

Step 1 : The user first needs to choose the operating mode - Pay/Receive, by pressing the **PAY/REC** button.

Step 2 : Next, the user has to enter the amount and press the **OK** button.

[3]Erasable Programmable Read-Only Memory



(a) Choose one mode. (b) Enter the amount.

(c) Enter the password. (d) Transaction Succesful.

Fig. 5: **Four simple steps showing the working of the device.**

Step 3 : In the third step, the user is required to authenticate himself/herself by entering the password.

Step 4 : Finally, the process gets completed on swiping one of the device's pins onto the metal pins of the other. Once the transaction is completed, a success message is displayed on both the devices.

• One can easily check the balance and the last 5 transactions by pressing the **BAL** button.

Fig. 6: **Devices displaying their current balance.**

III. Results and Discussions

TABLE I: Table showing the component wise cost.

Sr. No.	Name of the Component Used	Cost (for 1 device, in INR)
1	Arduino Nano	350
2	Li-Po batteries	345
3	LCD Display	150
4	Keyboard	80
5	Slide Switch	10
6	Connecting Copper Wires	15
7	Other expenses	50
	Total Cost	**1000**

The total cost of a single device is around **1000 INR**.

Since, two identical sets were made for demonstration, the total cost of the project stays around **2000 INR**.

The current cost per device is neither too high, nor too low. But, the cost can be largely reduced if the device is produced on a large scale.

IV. Conclusions

A. Advantages of this mode of transactions

Some of the advantages of using this device are :

1. Secure Transaction : Password based authentication is required. Hence, it is very safe to use.

2. Offline : No connectivity is required for the operation of the device.

3. Convenient : Operating the device is as easy as picking out money from the pocket and paying.

4. No fee for micro-payments : Some existing online wallets charge on transactions. Our device is hence, a one-time-investment kind of product.

5. Decreases theft tendency : The fact that the transfer of money to the person stealing the device is nearly impossible, makes our device less vulnerable to theft attacks.

6. Displaying the Current Balance and Transactions : The addition of this feature removes any kind of ambiguity in real life transactions. Also, this removes the necessity of keeping the track of one's daily expenditure, which is really difficult for the people belonging to the remote areas.

B. Future Implementations in the project

Some of the restrictions which currently exist in the device, can be removed. These are :

1. Restoring the lost device : A GPS based tracking system can be introduced in the device, in case the device is lost or stolen.

2. Replacing the damaged unit : If the device gets damaged, the data can be recovered from the device by storing it in a very rigid case (a black box kind of thing). Thus, rest of the damaged parts can be replaced easily, without any loss of money from either side.

3. Reduction in Cost : The cost per device can be greatly reduced if pins are made and used instead of using an Arduino.

4. Recognition : The device can get recognized as an official alternative mode of payment.

5. Increased Security : The password based authentication process can be replaced with biometric based one, without much increase in the cost.

Remarks : In this paper, the idea, implementation and future prospect of the project MUDRA was discussed. This device can be looked upon as an alternative mode of making payments, which encompasses the features of both : the currency notes as well as the digital money. The concept of the device lies in the fact that it does not depend on network connectivity, which is still a major hinderance in the aim of getting India, fully digitalized.

Acknowledgement

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Finally, this project might not have been succesful had it not been for the efforts of Robotronics Club, IIT Mandi. Hence, the authors would like to thank Mr. Indresh Kumar Gupta for the swiftness that was shown by him and the entire club, in arranging the necessary components.

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Hosty - The Automated Room

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***Abstract*—Time and again, we have felt the need of a smart room, a room which is at our finger tips. Hosty-the automated room give you the power to control the status of your room anytime on the go, by just calling at your home. There is just a need to enter appropriate keycodes and voila, the work is done. The automation helps the user control door (opening, closing and locking), curtains, lights and fans, and substantially saves ones time and efforts. It is highly efficient, reliable and very much affordable, unlike the automation systems up there in the market. With a unique ability to be controlled by calling system, room automation also saves your home from intruders. The system is versatile and can be used anywhere, be it a hostel, office or even a hospital.**

I. Apparatus and Materials Used

Serial no.	Materials Used	Quantity
1	5rpm Motors	2
2	Arduino Mega Board	1
3	L2983D Motor Driver	2
4	4 Switch Realay Board	1
5	Jumper Wires	50
6	BreadBoard	1
7	Aluminium Job	1
8	Rubber Tubes	1

II. Introduction

Generally, Home Automation is done by using Bluetooth,infrared Sensors or IOT(Internet of Things). But, Bluetooth or infrared Sensors are of short range and where areas internet is not available have no access to the system from the long distances. Keeping this in mind the call based approach is applied in the project.

A. *Relay Board*

Fig. 1. Four channel 5V with optocoupler relay board module KG127.

This is a 5V 4-channel relay interface board, and each channel needs a 15-20mA driver current. It can be used to control various appliances and equipment with large current. It is equiped with high-current relays that work under AC 250V 10A or DC 30V 10A. It has a standard interface that can be controlled directly by microcontroller.

1) *PIN Description:*

Input of relay board:-
A relay requires following 3 inputs to control the opening and closing of the circuit.
1. Vcc: Positive supply voltage.
2. GND: Ground.
3. IN1 - IN4: Relay Control Port.

Output of relay board:-

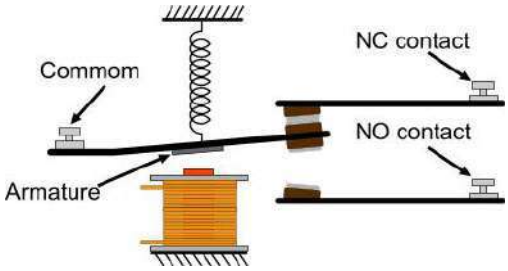

Fig. 2. Relay switch circuit.

1. COM (Common)- Is always in contact with either of the two pins, NO or NC.
2. NO (Normally Open)- If no current is flown it is disconnected from the COM.
3. NC (Normally Closed)- if no current is flown it is connected with COM.

B. *Dual Tone Multi-Frequency Module)*

This ”DTMF (Dual Tone Multi Frequency) decoder” circuit identifies the dial tone from the telephone line and decodes the key pressed on the remote telephone. Here for the detection of DTMF signaling, ”IC MT8870DE” isused which is a touch tone decoder IC. It decodes the input DTMF to 5 digital outputs.The ”M-8870 DTMF” (Dual Tone Multi Frequency) decoder IC uses a digital counting technique to determine the frequencies of the limited tones and to verify that they correspond to standard DTMF frequencies. The DTMF tone is a form of one way communication between the dialer and the telephone exchange. The whole communication consists of the touch tone initiatorand thetone decoder or detector. The decoded bits are sent to the Arduino Board and further processed.

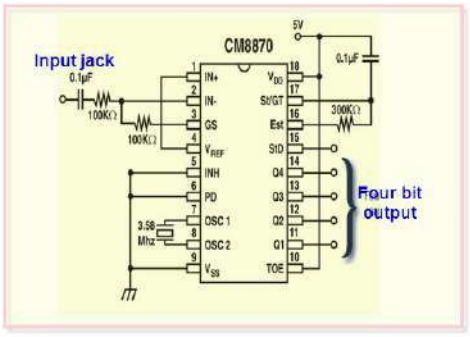

Fig. 3. IC MT8870DE (IC for DTM module).

C. *Door Lock*

To automate the lock of the door, the lock is rotated using 5rpm motor. For this an aluminium cover is designed for the lock, which fits in the lock from one side and other side get screwed with the motor shaft. The motor was fixed on the door with a wooden structure, which was screwed on the door.

D. *Door Handle*

The handle of the door is automated in such a manner that it is automatically pulled down before opening of the door and pulled up after the closing of door. This automation is achieved by pulley system consisting of two pulleys running with 5rpm motors and conveyer belt made of rubber.

E. *Door Opening*

Opening the door in its own is a muscular work, implementing it via machinery requires great force/torque. So, for this we had to understand the mechanism of Door Opener, we had to apply force on one corner of gate and it is hinged to its other end via metal plate and as the gate moves ahead that metal plate gets folded or takes shape of a V. So same mechanism will function for us as a door opener. This thing will initiate with that V which will reform its shape alternately to straight line when door is closed and revert back to V when door is open. For V we can use two plates (wood) and connect them with a screw so that the whole plate can change its shape. Now, one plate is of L-shape so that it can be connected to the door with a clamp which joins both plate and door together. And other part plate is of metal as it is connected to the motor to rotate whole system. This whole system is driven by 5 RPM motor which is controlled through arduino.

III. Theory

A. *Principle of Relay Board*

From the Fig: 4, it is clear that the signal port is at low level, the signal light will light up and the optocoupler 817c (it transforms electrical signals by light and can isolate input and output electrical signals) will conduct, and then the transistor will conduct, the relay coil will be electrified, and the normally open contact of the relay will be closed. When the signal port is at high level, the normally closed contact of the relay will be closed. The load can be connected or disconnected by controlling the level of the control signal port.

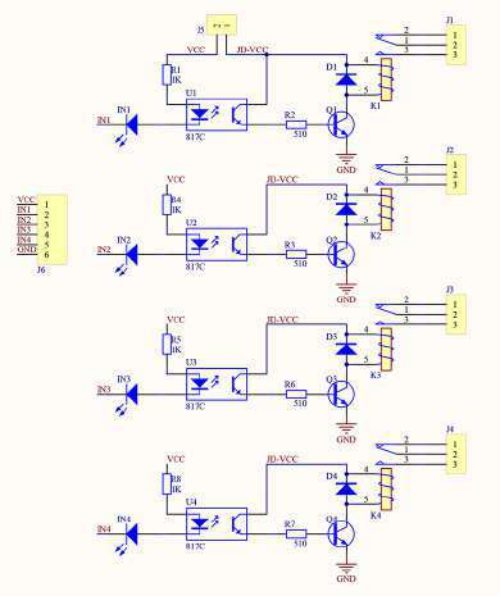

Fig. 4. Circuit of relay board.

B. *DTMF Module*

DTMF Module Takes Frequency as input and in Respond to the input give the corresponding output.

Button	Low DTMF frequency (Hz)	High DTMF frequency (Hz)	Binary coded output			
			Q1	Q2	Q3	Q4
1	697	1209	0	0	0	1
2	697	1336	0	0	1	0
3	697	1477	0	0	1	1
4	770	1209	0	1	0	0
5	770	1336	0	1	0	1
6	770	1477	0	1	1	0
7	852	1209	0	1	1	1
8	852	1336	1	0	0	0
9	852	1477	1	0	0	1
0	941	1336	1	0	1	0
*	941	1209	1	0	1	1
#	941	1477	1	1	0	0

TABLE I: DTMF truth table in which inputs are frequency range and output is binary code.

IV. Methodology

A. *Controlling Lights And Fans through Relay*

(1) First, step is to connect Vcc and GND to 5V and ground of the microcontroller respectively.

(2) Now, the input pins IN1, IN2, IN3, IN4 are connected to pin no. 6,7,9,10 of the Arduino Mega Board.

(3) Next, we opened the SwicthBoard to analyse the circuit so that we can modify it. Based on our understanding we decided to apply the relay switch in parallel with the manual

switches.

(4) The permanent live wire was connected with COM and the switch live wire was connected to NO for each fan and light.

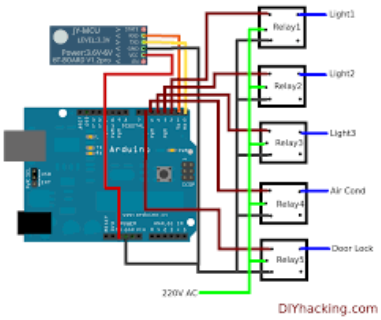

Fig. 5. Connection of Arduino And relayboard

B. *Door Handle Mechanism*

1) First of all the design of pulley system is created to control the handle.

2) Two pulleys of dimension 45 x 8 mm were made using wood on CNC Lathe Machine in Mechanical Workshop as per the design in fig.

3) They were properly grooved to pass the conveyer belt of rubber through them to complete the system.

4) Two clamps were designed to support the pulley and motor on the door.

5) Clamps of dimensions were created in carpentry room of mechanical workshop.

6) Finally every parts were properly assembled and the pulley system was made to automate the handle as shown in Fig. 6.

Fig. 6. Door Handle Mechanism

C. *Door Opening*

Firstly we had to fix the location of motor, then take quite accurate measurements of the distance between motor shaft and the end of door, this length is equal to sum of two equal size plates. For first plate we had to use wood and cut it in shape of L half the length of door, then for other half cut a metal plate. For welding motor and plate, we will take a 10mm diameter rod and drill it by 8mm (diameter of shaft of motor) it will act as a cover of motor and then screw both shaft and motor cover. For joining motor and plate, weld the cover of shaft with plate. Now we had to connect our model with the door for that we had to make two L-shaped clamp which will connect one end of wooden plate with door and other for fixing motor with wall adjacent to door. Fix one scre for connecting two plates. Thus, mechanism is ready to use.

D. *Door Lock*

1. We took the dimensions of the lock and then designed the cover of the lock in solid works. The motor holder was also designed on pen paper keeping the dimensions of motor in mind.

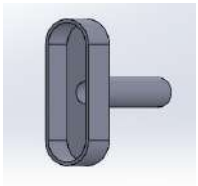

Fig. 7. Cover of Door Lock made using Aluminium Job in CNC Lathe

2. For the motor holder, wood pieces were cut in required shapes in the carpentry shop in mechanical lab and then joined with each other.

3. For the cover of the lock, a scrap aluminium job was operated on Lathe machine to attach the shaft of the motor and then operated on the milling machine to make channel in which the lock fits.

4. The complete system was assembled on the door and then motor was connected to the motor driver which is controlled by Arduino(microcontroller).

(a) (b)

Fig. 8. (a)Mechanical Design for opening door (b)Similar mechanism has been used in our prototype

E. *Curtain Working*

The mechanism consisted of two pulleys operated by a single motor (30 rpm). The motor driver was placed in the main circuitry board, which was in turn connected to the relay. On pressing '63' as keycode from the phone as IVR input, the relay renders HIGH to motor driver, which turns the motor on. The motor runs for 14.5 seconds, optimally opening the

curtains. On pressing '63' again, motors again start running in the reverse sense for the same span of time, thus closing the curtains. A single woolen thread, which has a comparatively higher tensile strength over cotton, was run over the pulleys. They were tightly tied over the pulleys to prevent slipping on the surface. Wooden pulleys were manufactured over lathe machine in the workshop.

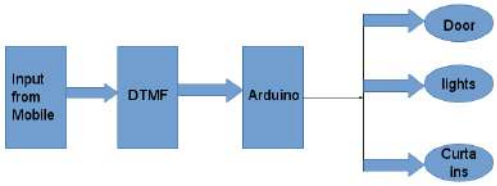

Fig. 9. Flowchart of Final Product working

V. Pseudo Code

```
WHILE 1
        if std is 1 THEN
                READ d0,d1,d2,d3
                assign input1 value formed by binary combination of d0,d1,d2,d3
                WAIT for 1 second
                READ d0,d1,d2,d3
                assign input2 value formed by binary combination of d0,d1,d2,d3

                IF input1 is 3 and input2 is 3
                        input = 1
                ELSE IF input1 is 3 and input2 is 6
                        input = 2
                ELSE IF input1 is 3 and input2 is 9
                        input = 3
                ELSE IF input1 is 6 and input2 is 3
                        input = 4
                ELSE IF input1 is 6 and input2 is 6
                        input = 5
                ELSE IF input1 is 6 and input2 is 9
                        input = 6
                ELSE IF input1 is 9 and input2 is 3
                        input = 7
                ELSE IF input1 is 9 and input2 is 6
                        input = 8
                ENDIF

                        CASE input OF

                                1 : Change state of lights
                                2 : Change state of Fans
                                3 : Change next state of lights to OFF whatever be the present state
                                4 : Change state of Curtains
                                5 : Lock the door
                                6 : Unlock the door
                                7 : Open the door
                                8 : Close the door
                        ENDCASE
        ENDIF
ENDWHILE
```

Actual code used in the prototype can be found on the following link :
$https : //drive.google.com/open?id = 0B5Skv_nLKJeDdnRhZ0o4bHBwU3c$

VI. Conclusion

1) We concluded that we should use rubber conveyer belt which provides proper elasticity and does not slide on pulley which was the case with woolen thread.

2) Proper Power supply is to be maintained because if motor gets more current than required it will just keep rotating and will not be able to provide proper torque. Hence it will be fused.

3)Wooden end of plate should be connected at the end of door for producing more torque.

VII. Improvements for future pursuing project

(1)We can place our system to top of door to open door more widely and to make It more efficient.

(2)Instead of wood we can use either hard plastic or metal to give it a shape of final product.

(3)Use of higher torque motors would make system more effective.

(4)User can be given option of using IOT, Calling or SMS system by combining all these things in the project

VIII. Acknowledgements

We are greatful to the following persons. Their expertise and suggestions helped improve this project.

- Dr. Hitesh Shrimali, Assistant Professor, IIT Mandi
- Dr. Gopi Reddy, Assistant Professor, IIT Mandi
- Pulkit Rajgadiya, 3^{rd} year, IIT Mandi
- Kushagra Singhal, 2^{nd} year, IIT Mandi

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Drawing Robot

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Instructor:-Prof. Hitesh Shrimali
Mentor:- Prof. Ankush Bag

***Abstract*—In this project we have made a drawing robot i.e a mechanical hand which will draw any picture provided to it with some restrictions. It works with the help of a arduino which is operated by commands written in MATLAB.The image given to our set up is converted into matrix form and then with the help of that matrix our mechanical hand is capable of sketching that image.**

I. Introduction

Our drawing robot is made up of combination of Arduino, servo motors, MATLAB software with arduino IO and some mechanical parts. Any colored picture consist of many combination of pixels. Each pixel is a combination of 3 different colors (red, green, blue). This pixels are converted into grey scale using MATLAB(i.e. RGB to grey). Canny edge detector algorithm detects the edges and convert the image into a matrix consisting of 1 and 0's. All the 1's occurs at the edges of the image and rest of elements of the matrix are 0. Joining all this 1's our sketch gets completed with the help of our mechanical set up which consist of mechanical hands, servo motors and marker connected to one of the servo motor. This command of connecting all this 1's is given by our algorithm.
Servo motors are the motors which rotates at specific angle which is provided to it by the arduino signals. It's range of rotation is from 0 to 180 degrees. It consists of 3 wires. One is connected to ground, another one is connected to current supply and the last one is our signal wire connected to arduino.

MOTIVATION:-We got the idea of making this drawing robot from our classroom itself.As we all know that in our lectures we are taught by presentations and we all does not get the feel of our traditional teaching method of chalk and board.So,our team decided to solve this problem and move forward in this direction.Also this robot can help us to copy notes from our friends.

II. Equpiments used

- Arduino UNO
- 3 Servo motors
- 5V 2A Adapter
- USB Cable
- 2 Castor wheels
- 2 Metal strips 20cm long
- 2 Metal strips 15cm long
- Jumper wires
- screws
- Double sided tape
- Glue gun
- smooth marker or pen

III. Software used

- MATLAB
- Aurdino I/O Package

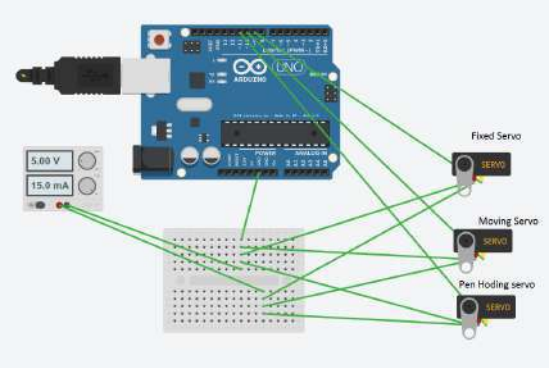

Fig. 1. Circuit Diagram

IV. Inverse Kinematics

Arm length of our robot are 20cm each. So to trace the Cartesian plane we will move our robot by changing the angle A and B of the servo motors.

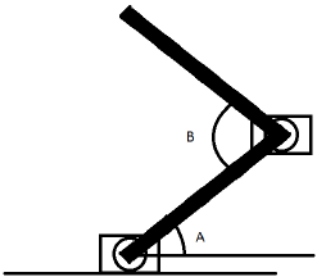

Fig. 2. 2 link Arm

A. Using forward Kinematics

$$x = 20 * (/cos(B - A) - /cos(A)) \quad (1)$$

$$y = 20 * (/sin(B - A) + /sin(A)) \quad (2)$$

Using squaring and solving the quadratic equation.we get the Inverse Kinematics Equatation as

$$\cos(B) = \frac{(800 - x^2 - y^2)}{(800)} \quad (3)$$

$$A = \arctan\frac{x}{y} + \arctan(\frac{B}{2}) \quad (4)$$

V. Procedure

- Make the metal strips of desired length from raw metal sheet.
- Using drilling machine drill holes in metal strips.
- Join the servo motors with metal strips using screws.
- Now attach the Castor wheels with the setup at appropriate places.
- Attach the marker with the servo motor which is at the end of the setup with the help of glue.
- Set this mechanical setup on a wooden platform.
- Connect all the servo motors with arduino using jumper wires.
- Simultaneously work on algorithm which can implement our job.
- Implement this algorithm and write the appropriate code in MATLAB .
- Now connect adapter with the arduino.
- Use USB cable to connect arduino and lappy.
- Set a blank paper(whose surface is smooth) below our setup .
- Now set the co-ordinates in the code.
- It's time to provide a picture, so that our mechanical setup will draw it's sketch.
- Now run the code and our mechanical hand goes on to it's work.
- After waiting for some period of time our sketch is ready.

VI. Mechanical set-up

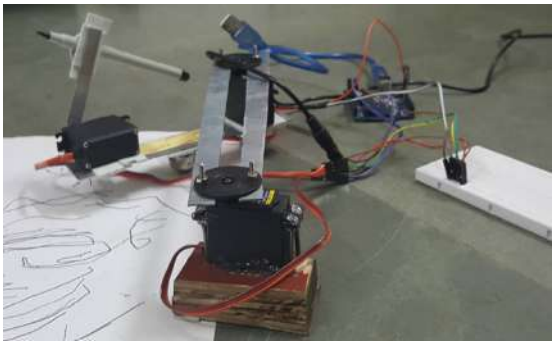

Fig. 3. Mechanical setup

VII. Results and discussion

- Operating servo motor and it's functioning .
- Using Arduino UNO, it's working principle and functioning.
- Working and usage of MATLAB.
- Implementing inverse Kinematics in daily life problems.
- While Joining the points,sketch may get distorted due to lack of proper calibration.
- High resolution picture takes more time, as it has more pixels.
- High resolution picture have too many details that can create mesh.
- Difficulties while making mechanical hand setup.
- Less precision of our servo motors.
- Proper error handling of our algorithm.

VIII. Converted image

Fig. 4. Image given

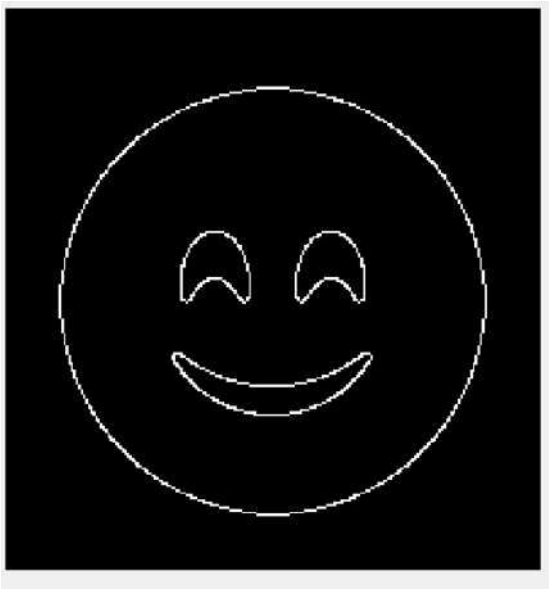

Fig. 5. Converted image

IX. Conclusion

- BLACK BOARD WRITTER
  As we all know that chalk and board mode of education is more effective and student friendly than presentation one.But,Nowadays it has observed that most of the institution adopted the presentation mode of education.So,our project can eradicate this problem.We are having a moving robotic hand which can draw the presentation slides used by professor,which will be beneficial for both professor and students.

- CALLIGRAPHY
  Drawing robot is capable of writing font's in different styles such as calligraphy.

- RAANGOLI MAKER
  Our project will solve the problem that most of the girls and ladies face while making raangoli during some festivals.Our robotic hand will draw the raangoli design which will be feeded in it.It will also fill up the colors in raangoli according to one's choice.

- PAHARI PAINTING
  As we all know pahari paintings are very costly and our robot can sketch similar pahari painting.

X. Other upgraded uses

- 3-D printer.
- Zoom-in and zoom-out instantly by changing arm length.
- Pattern lock opener.
- And all work that requires moment in 2D Cartesian plane.

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Cricuit of Aurdiuno Board is created from

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ISHAARA - The Helping Hand

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***Abstract*—There is a large community in our society who can't speak. It creates a barrier or communication gap between them and normal people. As we all know that mute people normally express their feelings in terms of sign language or gestures. In order to tackle this problem in most economical way we have proposed a device "ISHAARA". This device works as a medium to communicate in such a way that hand gestures made by the mute people will be displayed and further converted into audio signals so that normal people are able to understand what they want to say. Further this device can be used in many practical problems.**

I. APPARATUS USED

Flex Sensor, Arduino Uno, R-F Module, Motor Shield, Resistances, Breadboard, Motor Set, Glove, Jumper Wires, DC power supply

II. INTRODUCTION

Communication is a way to express one's thoughts, feelings, and past experience with other people. Communication can be verbal and non-verbal. Unfortunately dump people can't communicate with normal people verbally. Sign-Language is developed for helping dumb people to communicate. Sign-language is a non verbal form of communication which involves Hand-Gestures, facial expressions and other articulation for communication . Normal people can't understand it until they learn sign language. So there is a huge communication gap between dumb people and normal people. We have tried to reduce this communication-gap by creating a device which converts sign language to normal voice. We call it "ISHARA-The Helping Hand.". This Helping Hand not only converts sign-language to voice but also moves the wheel chair based on Hand -gesture. Gesture recognition can be done Visually or by using sensors. Basically this is a flex sensor based device. Flex sensors works on voltage divider principle. It changes resistance based on the movement of fingers. We have five flex sensors which creates 32 combination of 0's and 1's. We have assigned 26 combination for 26 alphabets of English language. For moving wheel chair we are using these 32 combination once again.These signals are transmitted using R-F Module. Arduino process them and finally a text to voice conversion application convert them to Voice. Further movement of Wheel chair is based on hand gestures. Well this a project which is a boon for differently-abled people for sure.

III. MOTIVATION OF THE PROJECT

Real time world recognises languages such as American, British, Turkian etc. and we know that presently the projects going on the conversions of sign language are based only on a particular language.Futher it has only one type of application either converting gestures to language or something else. But with the help of our device we can assign our own sign convention for any type of language and type of user using it. At the same time these sign conventions can be assigned to operate other things like wheelchair ,for room automation etc. For every finger we specified some bending angle and when our finger are straight its state is 0 and when it is bend above the specific angle for a specific finger then its state is 1. Since every finger represent 1 bit so we have 32 combinations. So, we can assign this 32 combination as sign input.

Fig. 1. Hand Gesture showing combination 01000

Also, Nowadays to make such type of project concept of image processing and accelerometer are used.The limitation while using this concept is user have to move his hand in front of camera correctly for a specific peiod of time and also for accelerometer we need more precise movement

of hand.According to researchers this method has too low accuracy i.e 30 to 40 percent. When we are using flex sensors for a hand guesture which work on the basis of voltage division principle,we get too high accuracy and this is more efficient comparing to other method.

IV. SYSTEM ARCHITECTURE AND COMPONENTS

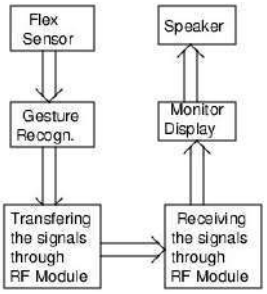

Fig. 2. Block diagram of system

A)Flex sensor : A simple flex sensor 2.2 inch length. As the sensor is flexed, the resistance across the sensor increases. Flex sensor have polymeric ink which comprises conductive particle which when bent allows conductive particle to move apart and thus increasing the resistance.

Fig. 3. Flex Sensors Positions

B)Arduino Board : Arduino is an open-source platform which can be used for building electronics projects. Arduino consists of both a physical programmable circuit board (often referred to as a microcontroller) and a piece of software, or IDE (Integrated Development Environment) that runs on our computer, used to write and upload computer code to the physical board.

C)RF- Module :An RF module(radio frequency module) is small electronic device used to transmit and /or receive radio signals between two devices.

D)Motor-shield :this sheild is based on the L298, which is a dual full bridge driver designed to drive inductive loads such as relays, solenoids, DC and stepping motors.

V. WORKING OF THE PROJECT

The Key Foundation of this Project is the 'Flex Sensor'.It works on the principle that it's resistance changes when it is bent because of the conductive particle in it move apart. So, added a resistance in series with the flex sensor and according to voltage division principle measured the voltage across the resistance. After that divided the angle according to the voltage and then marked a certain angle before which we treated the Finger as '0' and after that certain angle as '1'.

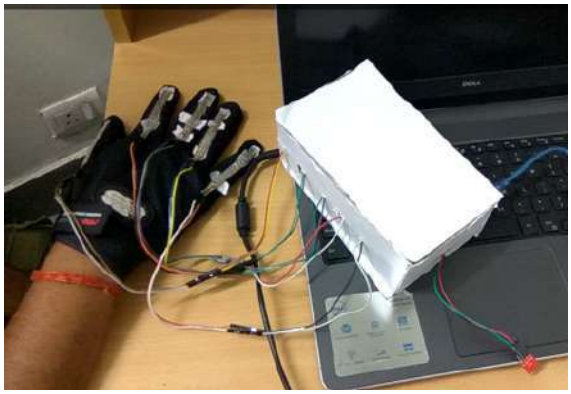

Fig. 4. Signal Transmitting Part of the Project

Placed the 'Flex Sensor' on each Finger and the Thumb .So, there were now 5 bits loaded on this hand. This resulted in 32 combinations of the 5 Fingers ,Out of which 26 were used for each alphabet.

Alp.		CODE			
A	1	0	1	1	1
B	1	1	1	1	0
C	1	0	0	0	0
D	1	1	0	1	0
E	1	0	0	0	1
F	1	1	0	1	0
G	1	0	1	0	0
H	1	0	1	1	0
I	0	1	1	1	1
J	0	1	0	1	0
K	1	0	0	1	0
L	0	0	1	1	1
M	0	1	1	1	0

Alp.	CODE				
N	1	1	0	0	1
O	0	0	0	0	1
P	1	1	0	1	1
Q	0	1	1	0	0
R	1	1	1	0	0
S	0	0	0	1	0
T	0	0	1	0	0
U	0	1	0	0	0
V	1	0	0	1	1
W	0	0	0	1	1
X	0	1	0	0	0
Y	0	0	1	1	0
Z	0	0	1	0	1

Fig. 5. Hand Gesture Combination for English Alphabets

1. Hand Gesture To Speech

When performed the corresponding combination of Fingers, the 'Transmitter' of RF Module connected to 'Arduino' sent those signals to the corresponding 'Reciever' of that RF Module, Reciever is further connected to another 'Arduino' which after converting those signals into alphabet displays on the screen of Laptop or any other LCD.

Doing these combinations in a continuous manner results in printing of a word as an output. From here the words are copied automatically using a software in the text box of a ”Whatsapp” account opened in the Laptop, the same way as if a normal person would have done. Commands were given to it to do the same, and finally this software sends the message.

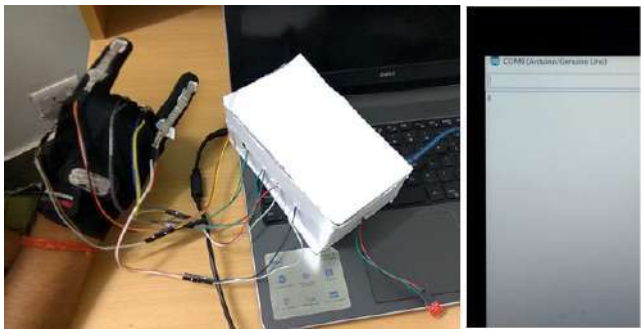

Fig. 6. Hand Gesture Combination for H and corresponding Display

This message is received on another ”Whatsapp” account in a smart phone which has an application installed in smart phone which served the purpose of speaking the received message. Hence, giving voice to the people who are unable to speak.

2. Hand Gesture To Wheelchair Automation

Directions	CODES				
Forward	1	0	1	1	1
Backward	1	0	0	1	1
Left	0	1	1	1	1
Right	1	1	1	1	0

Fig. 7. Hand Gesture Combination for Wheelchair

We used 4 combinations from above 32 for the 4 directions of movements of wheelchair (All 32 combinations can also be used for different speeds and more directions of the wheelchair).

When performed combinations of Fingers ,the ’Transmitter’ of RF Module connected to ’Arduino’ sent those signals to the corresponding ’Receiver’ of that RF Module, connected to ’Arduino’ which further connected to the ’Motor Sheild’ giving corresponding commands to to Motors of wheel chair and hence,it moves. We made use of only 2 Motors and hence for ’Left’ and ’Right’ directions of the wheelchair rotated wheels in the the opposite sense.

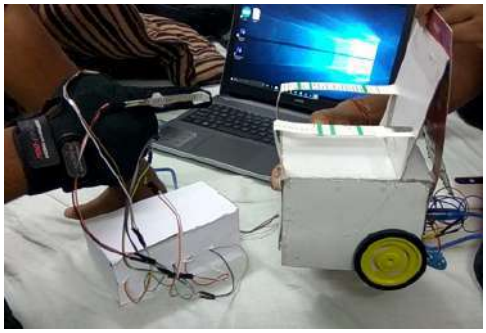

Fig. 8. Hand Gesture combination for forward and corresponding motion

VI. RESULTS AND DISCUSSION

This project includes the use of Flex Sesnor, Ardiuno Uno, RF Module, Motor Sheild, Motors. It can convert a persons hand gesture into voice and also displays the meaning of the gesture in the display. Further persons hand gesture can be used to move a wheelchair.
This project is basically a combination of four parts. Firstly converting the hand gesture to binary form for which flex sensors variable resistance and voltage division principle was used. Second part was to send this binary form to the display connected ardiuno for which RF module was used. Third part was to convert this binary code into alphabets and making a proper word. Fourth part was to convert this word into audio for which certain type of softwares were used. At last the four parts were combined and thus gestures were converted into audio.

VII. CONCLUSION

Ishara-The Helping hand is an advanced device which empowers the dumb people and give them the ability to speak. It reduces the communication gap between dump people and normal people. Further it enables the movement of wheel chair simply by hand gestures.

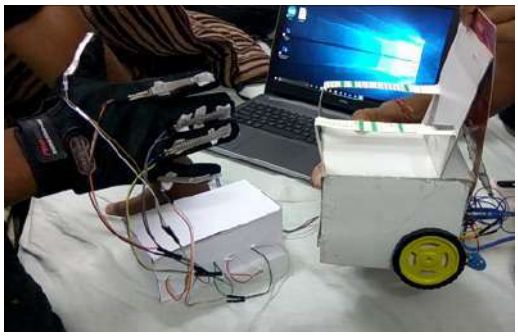

Fig. 9. Hand Gesture to Wheelchair automation part of project

This device is easily implemented using five flex-sensors. These sensors sense the hand-gestures and send signal to Arduino where they gets processed. Then the signal is send

to text to voice conversion application and we get desired Voice. For moving wheel chair signal is send to other arduino which drives the motors thus this is a very economical and efficient device.

VIII. FUTURE SCOPE

This interactive can be used to solve many real life problems like :

1) It can be a tactical device for Human - Computer interaction. As this device sense Human-body language and give inputs to Computer accordingly.
2) It can be used for underwater communication for scuba-divers.
3) It can be used for Space communication for astronauts.
4) It can be used to convert one language to another.
5) It can be used in home automation.
6) It can be used in robotonics.

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Projecthiko 1.O - The Voice & Internet Enabled Smart Home

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Abstract*—The project is focussed towards making the lives of people easy and comfortable. But doing this generally harms the environment , hence keeping this aspect in mind, this paper is based on the project of home automation system. The automation is done using recognising the speech taken by the user and the inputs taken by user on his mobile phone which in turn should be connected to internet. The environment is also protected because all the electric and electronic components in house can be accessed remotely. This reduces the human effort and saves a lot of energy. Because now, no mother has to call her son to tell him to switch off all the lights in the house before going out of the house, as she can just say "*room lights off" or tap on the button which says the same thing. This in turn also saves a lot of money. According to some calculations, an automated house can observe a cut of 15-20 percent in electricity bill.**

I. Introduction

The name "Hiko" means electricity/elctrical in maori language. The whole project is set up to save electricity. Major list of items used here are:

Items Required
Raspberry Pi 3 Model B
Microphone
Sound Card
Light Emitting Diodes
Physical Model
Jumper/Connecting wires

Any invention/remake is done with keeping in mind the following three aspects:

1) Protects the Environment (Does no harm would also suffice)
2) Comfort for the user
3) Cost of development must be less

The elements listed below gave the motivation for making a prototype like this:

A. Protects the Environment

On an average, every house has a set of rooms in which lights are always "ON" and only because people in the house have frequent visits in the room or in the night time, it is difficult to find the switchboard when the lights are "OFF". The Television generally operates 18-19 hours continuosly in the house. And unknowingly, it utilises a lot of electrical energy. What if we have some system by which there is negligible loss? The amount of fossil fuels burnt(still a major stakeholder in terms of energy) which depletes the environment can be reduced to a favourable level. However this can only be achieved when systems like hiko are installed in most of the houses of the world.

B. Making Life Easy

Take a situation, there is a patient instructed not to move from bed. Worst thing happens if he/she lives alone. Is there a way by which he/she doesn't have to move a bit and can operate anything in the house? Yes! its hiko. Taking this situation to the life of students makes it even worse. The switchboard of the whole room is situated on a particular wall. If a student is going to sleep, due to his/her laziness, he/she doesn't switch off the light and passes this responsibility on his/her room-mate. And this thing never ends and the lights are never switched off. Consider this happening in almost 40 percent of the hostel rooms. And yes! This is a huge number. Think how good it could be if all the room-mates have a specific app installed in their mobile phones and can operate the lights and fans from that app.

C. Cost Analysis

The proposed model (a prototype) consists of 5 automated rooms, 1 Gate, 1 Fan 1 Lift. The prototype costs only Rs.4976. On adding the cost of relays, wires and adding some profit for the developer, one can sell it for Rs. 8000. This is quite cheap. Amazon Echo Dot[12] which only is a speaker comes for Rs. 10000. On installation of full home automation of Alexa, the cost goes as high as Rs. 2,00,000 or in some cases even more.

D. UI Goals

The basic idea behind hiko is developed after thinking upon these important points. The final model has to be interactive with the user. The user must *NOT* get bored of the hiko. The webapp developed to manage the house using phone must be catchy. It should also be very easy to use.

Further sections in the paper are divided with headings, how things work, features and commands, circuit diagram and explaination, pseudo code, results and conclusion.

II. HOW THINGS WORK?

A. *Devices and Items used:*

1) Pi 3 Model B: Raspberry Pi 3 Model B is a small single-board computer, originally developed by the raspberry pi foundation to promote the teaching of computer science in schools. But later students started toinvolve it in robotics and hi-end computing. The Raspberry Pi 3 Model B uses a Broadcom BCM2837 SoC with a 1.2 GHz 64-bit quad-core ARM Cortex-A53 processor, with 512 KB shared L2 cache. It runs at 1GB DDR2 RAM. Its power rating is 700mA (3.5W). It is provided with 4*USB2.0 ports which can be used to connect keyboards and mouse. It has inbuilt wifi module and bluetooth module unlike Raspberry Pi 2. Raspberry Pi 3 Model B features 802.11 b/g/n 2.4 GHz WLAN and Bluetooth modules. The Raspberry Pi has a set of GPIO(General Purpose Input Output) pins which can be programmed using the python library GPIO. We can take inputs, give outputs using these GPIO pins. It also has multiple "Ground", "5V", and "3.3V" pins mounted on it for convinience.

Figure 1. Raspberry Pi 3 Model B[7]

2) IC L293D: L293D[6] is a typical motor driver IC which allows the DC motor to rotate in either directions. IC L293D is a 16 pin IC which can control two motors simultaneously.It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor. We have used the motor driver to externally supply more voltage to LED's as well.

3) Sound Card: It is a simple input/output device which provides input and output to the computer when prompted by the computer programs to do so. They are DAC (Digital to Analog Converters).

Figure 2. L293D Motor Driver[6]

B. *Voice Recognition:*

Voice recognition is done using the Google Speech API[11]. API stands for Application Programming Interface. The Google Speech API provides a web link. After recording the voice sample, the voice sample gets pushed to that link, it analyses the data and converts it into text and returns the text file. Then a simple algorithm of idenitifying the text in a string written in Python3 comes into play and analyses the text and gives the suitable outputs to GPIO pins according to the inputs. Any speech API works on majorily 3 databases:

1) Acoustic Model: Analysis of type of sound. Depends on the charachteristic of the person who is speaking. This property is specific to a person.
2) Lexicon Model: Analysis of how words are formed. How they are spelled. Not specific to a particular person. In short it is Universal.
3) Language Model: Analysis of how sentences are framed using different words.

One of the major goal of home automation is to make the voice recognition universal and not specific to a single person. Because the basic access to the things in house can be given to any person in the house.
Due to this major concern, the Acoustic model of the Speech Database can not be used. Only the Lexicon and Language models must be used. There are two kind of open-source API's available. One is online, where the database in online. And the other is offline, in which the database is installed on the local device - for the project, that local device is Raspberry Pi. The online kind of API's are highly dynamic due to the fact that they can maintain a huge database. Else, local database has large numbers of setbacks due to less memory in Raspberry Pi 3 Model B (Limited to a maximum of 64 GB). The random access memory is also limited to 1GB as quated earlier.

C. *Mobile/Web Platform:*

The another key aspect of the Projecthiko1.O is the webapp which is created independently, extensively using HTML5, CSS3, JavaScript and Flask. The front-end User Interface is

developed keeping in mind the general trends of usability. The main aim is to make it interactive, user-friendly and a User Interface, which can be used by any age groups and used in any device. Best way to do is developing a webapp. This webapp's frontend is based on HTML5 and CSS3.The front-end device compatiblity is handled using JavaScript. The backend support is what makes the webapp really working. For that there are multiple executable python files which turns on and off various devices are created. A package of Apache2, php5, sqlserver is used. This package is popularly known as "LAMP[10]". Then the LAMP server comes into play. All these things are hosted on Apache2 server. The backend is accessed through flask[9], where the flask is given a particular URL to each and every button. Just on visiting the URL, the operation is performed. This gives universal access to the home.
The front-end UI is available online[8].

D. *Physical Model/Prototype:*

All these things were implemented on a physical model (prototype) which is developed to showcase the functionings. It is made up of scrap lying outside newly constructed buildings, useless wooden material, packaging boxes.

III. FEATURES OR COMMANDS

A. *Light Operations*

The lights of any room can be operated by including these three words in any order in your sentence = "lights", "state(on/off)" and "room(Name of the room)". You can speak out for e.g.: "Bedroom Lights off" and the bedroom lights would turn off. If lights were already off, it would respond with "Already Off". To turn off the lights of all the rooms, you just have to say: "good night". This phrase is quite useful because at the night time, instead of going to each room and checking whether the lights are on or off, one can just say good night. Nor would one miss any room and neither have to put efforts from his side.

B. *Fan Operations*

The Fan can be operated in the same way as light does. The only difference lies in the part where by a single command, the user turns off all the lights in the room. This case can not be with the fan due to the fact that, the user only turns on the fans when it is really required. Hence in a summer night, if we say "good night", nobody wants that the fan also gets turned off. Hence the commands like "good night" operates only on lights.

C. *Lift Operations*

The lift operates when the user speak out the floor where one wants it to be. Generally, we have to wait for the lift to come from some floor. The user constantly press the calling button. Now, what one can do is to just call out the "floor" "state(where one wants the lift to be)" in their sentence and it would come to the floor they want. It saves a lot of time.

D. *Door Operations*

On giving the input about the door and the state in which the user wants it to be, one can easily operate the door. Two phrases "door" and "state(open or close)" have to be included in the sentence. The operation will take place. This is realised using 9g Servo Motor(weight of servo motor is 9 gram) which is given the angle inputs through the GPIO pins.

E. *Keyword*

The main problem one faces while realising all these tasks, is that the machine takes random inputs. It also takes the daily conversation and its very likely that a person mentions "lights" and "off" in the same sentence when one wants the lights to be on. A simple solution to this is putting a keyword into play. The machine gets active only when input is a particular phrase, In this case, the phrase is : "OK Hiko". After hearing "OK" Hiko, it can do whatever speak.

F. *Special User*

This is the most unique feature which seperates hiko from all the automated assistants. A special user in a house is the person who has the access to each and every electric or electronic components in the house. It also has some special features included. A special user can ask: "What is the time?" , "How is the whether outside?". It replies suitably with realtime data extracted from internet.

G. *Webapp Features*

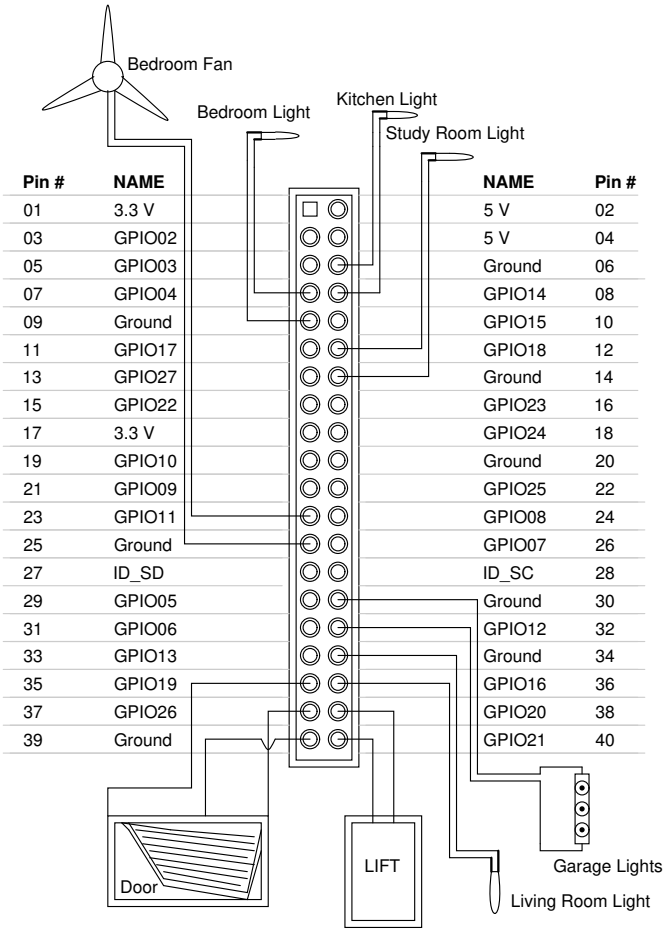
Figure 3. Control Panel of the house. Click on the room for which you want to operate for:

The control panel visible in Figure 3 is for whole house. For a particular operation related to a particular room, one has to click on that button. Then a window would be shown like in Figure 4.

Figure 4. Buttons for the particular operations. The user has to click on desired button to operate.

This is the Control Panel of that particular room. It lists all the components which can be controlled using this webapp and includes the buttons to operate it.

IV. CIRCUIT DIAGRAM AND EXPLAINATION



Pin #	NAME	NAME	Pin #
01	3.3 V	5 V	02
03	GPIO02	5 V	04
05	GPIO03	Ground	06
07	GPIO04	GPIO14	08
09	Ground	GPIO15	10
11	GPIO17	GPIO18	12
13	GPIO27	Ground	14
15	GPIO22	GPIO23	16
17	3.3 V	GPIO24	18
19	GPIO10	Ground	20
21	GPIO09	GPIO25	22
23	GPIO11	GPIO08	24
25	Ground	GPIO07	26
27	ID_SD	ID_SC	28
29	GPIO05	Ground	30
31	GPIO06	GPIO12	32
33	GPIO13	Ground	34
35	GPIO19	GPIO16	36
37	GPIO26	GPIO20	38
39	Ground	GPIO21	40

Figure 5. Circuit of the whole hiko system[3]

The cicuit in Figure 5 is the main circuit of hiko. Shown in the figure are GPIO(General Purpose Input Output) pins. These are connected to Fan, Lights, Lift etc. These pins can act as output or even input pins, analog or digital.

V. PSEUDO CODE

Algorithm 1 Algorithm for Data Interpretation

procedure STRING INPUT ON KEYWORD ACCEPTANCE
  string ← file.txt
  if "$OKHiko$" *in string* **then return** true
  enter to hiko
loop:
  if "$RoomName$" *in string* **then**
  if "$DeviceNameAndState$" *in string* **then**
  $Device \leftarrow State$
  goto *loop*.

VI. RESULT

The voice recognition algorithm works properly and gives correct outputs according to the given voice inputs. The commands given using webapp are correctly recognized by the system and the tasks given are implemented in the desired way.The system works properly on the prototype developed.

VII. CONCLUSION

The automated home is very effective in terms of cost, usability, comfort. It is highly efficient as, on taking extra energy input, it has the capabilities of reducing the energy consumption on a whole. The system is highly interactive and very user friendly which makes a customer buy it. Also, the webapp developed is highly responsive and interactive. The UI is also user friendly. The model only did show a limited usage of what it can do. Say it a lack of money or lack of resources. It has a wide range of applications. Practically, the system can be connected to each and every thing present in the house.

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Smart Street Lights

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***Abstract*—In this project, we are making an energy efficient system which is implemented on street lights. Generally, we see that there is unnecessary wastage of energy on streets due to street lights. To avoid that and to make a suitable system for the people who are using thsese roads, we have made this model of above system called Smart Street Light.**

I. Apparatus used

Arduino (Mega 2560)
Infra Red Sensors
LES's
Light Dependent Resistors
Transistors(BC 547)
Resistors
LCD Screen
Bread Board
Jumper Wires
Physical Model.

II. Introduction

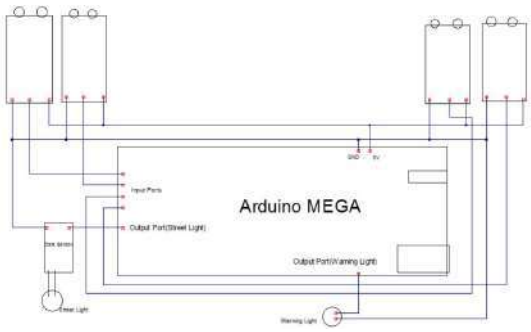

Fig. 1. Street light circuit diagram.

AN energy efficient system(Fig. 1) in which street lights turn off automatically during day time and lights glows at 10% intensity when the road is empty. When a person or car or any obstacle is passing on the road, we should turn the lights on. We used infrared(IR) sensors to sense the obstacle. After sensing it, we did process on it and for that, we used the Arduino Uno as a microprocessor. We used two IR sensors at a place so that we can decect direction and velocity of the obstacle passing through the road. Once sensors detect that there is obstacle passing inside the smart street light zone, arduino processes on it and glows the lights of particular zone where the obstacle is passing. When sensors detect that obstacle has passed from one particualer zone to other, lights of the previous zone gets back to 10% intensity and the street lights of the current zone glows at 100% intensity. As we are calculating velocity of an obstacle, we could implement overspeeding detector system so that we can warn the vehicle driver. Also on day time, we don't need lights on streets. Instead of turning them off manually, we have made an automatic switching system using Light dependent resistors and transistor. we could count how many obstacles are passing through the street and use this data to know the use of a particular road and accordingly we can know how much maintenance is needed for a particular road which will be helpful for the road development department to pass the budget for a particular road or street.

III. Discription of components

[3]

A. Arduino Mega

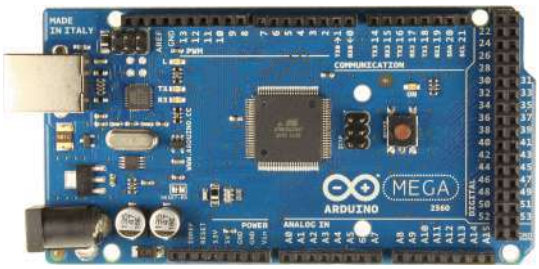

Fig. 2. Arduino MEGA 2560 image. [1]

Arduino(Fig. 2) is an open source software compny that designs microcontrollers and microcontroller kits used for interaction between digital devices and objects in physycal world. The Arduino project was started in 2003 in Italy for the students to learn electronics and create devices that can interact with the envoirment using sensors. Common

examples of such devices are line follower bot, motion detectors etc. The programming in Arduino can be done in languages C, C++ and many other languages. Arduino can be used as a platform for learnng of computing, engineering and mathematics with robotics., it can alsobe used for virtual reality applications. It can be used to programme drone software to create video games and many other electronics applications. the Arduino takesl signal from sensors, makes it compatible with the programme and gives the desired output.

B. IR sensors

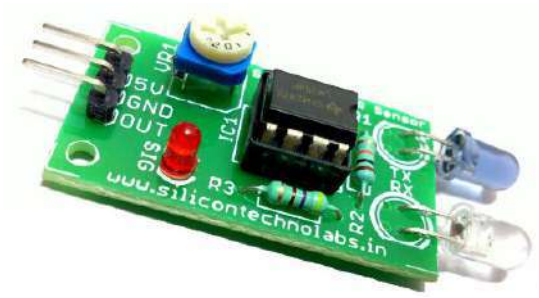

Fig. 3. IR Sensor. [2]

An infrared sensor(Fig. 3) is an electronic device that measures light radiating from the objects in the region of its field of view. All objects above absulute zero or 0 K temperatures emitis energy in some forms of radiations, usually heat energy which is invisible to human eyeas it radiates infrared wavelenghts but can be detected by IR sensors. The IR radiation enters from the front of the sensor, commonly known as sensor face. The core of the IR sensors is made from pyroelectric materials, which generates energy when comes in cantact with heat. An IR sensor can be used as motion detectors to sense movement of any obstacle like vehicles, animals or other objects and are commonly used in automatically activating lighting system and security alarms.

C. Light Dependent Resistors

A LDR(Light dependenr resistor)(Circuit shown in Fig. 4) also known as photoresistor or photoconductive cell changes its resistance accordingly with the intensity of light falling on it. The resistance of a photoresistor decreases with increasing intensity of light and increses with decreasing intensity of light falling on it i.e. resistance of photoresistor is inversely proportional to intensity of light falling on it, ehibiting photo-conductivity. A photoresistor is made up of a high resistance semiconductor which can have aresistance as ahigh as few mega ohms(MΩ) on the other hand it can have a low resistance of a few hundered ohms in light. When light falls on a photore-sistor or LDR, the electrons in valence band absorbs energy and gets excited to the conduction band thereby increasing the value of current or equivalently we can say the resistance in the circuit has ben decreased with the light falling on it.

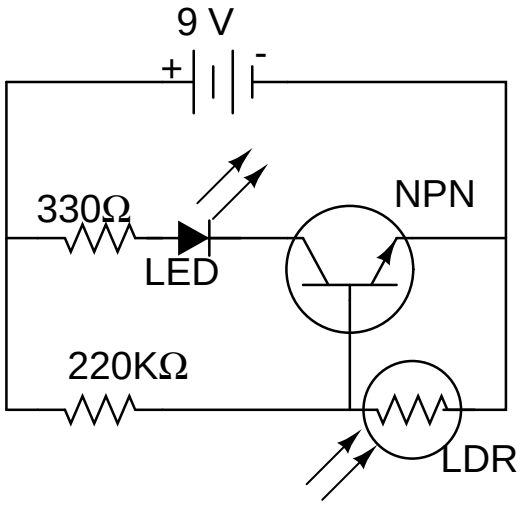

Fig. 4. Circuit diagram for dark sensor.

D. Dark Sensor

The dark sensor is a circuit that is used to operate accordingly with the darkness in the environment. The circuit for dark sensor inludes a npn BC 547 transistor, an LDR, LEDs and resistors. The transistor can be used as an amplifier or as a switch. In dark sensor transistor is used as a switch and operates with LDR accordingly at day and night times. When the voltage at anode is higher than at cathode in a diode, the diode is said to be in reverse bias and in forward bias if the voltage at cathode is greater than at anode. The transiator acts as an on switch during night time when both the diodes gets forqward biased and as off switch when both the diodes gets reverse biased at night and day time respectively.

E. LCD Display

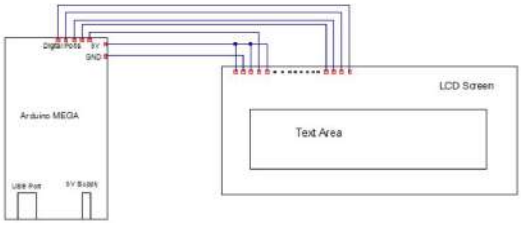

Fig. 5. LCD screen circuit diagram.

The LCD display used in the project had 16 connec-tions(Fig. 5) or pins that needed to be soldered. the first pin or Vss is for ground, the second pin or Vdd is for 5V supply, the third pin is the Vo pin that adjusts the contrast of the LCD screen, the fourth pin is the RS pin which stands for register select and this pin lets you choose between sending commands or sending characters to the LCD, the fifth pin is the R/W pin that stands for read write and lets you select between giving an instruction to the LCD like clearing the screen or sending data and reading information from the LCD and we can connect the R/W pin to the ground, the sixth pin is the E pin or enable pin which behaves as sort of a light switch for the LCD and

executes the command, next we have pins d0 which is a 8 bit parallel data port for the LCD and is given the 8 bit value of the character or command that we want to send. The last two pins are the anode and cathode for the LED backlight.

IV. Working

A. Sense obstacle

Fig. 6. Lights glowing in vehicle's zone.

As vehicle or obstacle passes through the road, IR sensor decects it. If obstacle is passing inside the smart street light zone, firstly, first IR sensor will sense the obstacle. As obstacle passes, both the sensors which are kept near to each other as shown in Fig. 6 will detect thwe same obstacle. When obstacle moves further with same direction, first sensor will stop sensing and second will be keep on sensing and after some more movement of obstacle with same direction, second IR sensor will also stop sensing. In this whole process, we can declare that obstacle has come inside the Smart street light zone. This whole data will be taken by Arduino. Now, as our programme(in Arduino) declared that there is an obstacle inside, Arduino will process on it(Fig. 6).

B. Processing of data of Obstacles

By using IR sensors, we have given the input to the Arduino that there is a obstacle inside. Now, as per that data, accordingly microprocessor(Arduino) will sense and count each and every obstacle comming inside the zone. As obstacle is inide the zone, microprocessor will give the command to light circuit which is further connnected to dark sensor circuit.

C. Dark Sensor

Dark sensor is the one which will allow the signal only if there is low intensity light. Now using IR sensors and microprocessor, it is clear that there are number of obstacles(vehicles) on the road which are in zone and darksensor also got the command from microprocessotr to glow the lights. Now, dark sensor will check whether there is day or night. If it is day time(Fig. 7), it won't allow the comming signal to glow the lights as we don't require street lights on day time. If there is night or dark outside, it will pass the signal to the street lights and lights will glow.

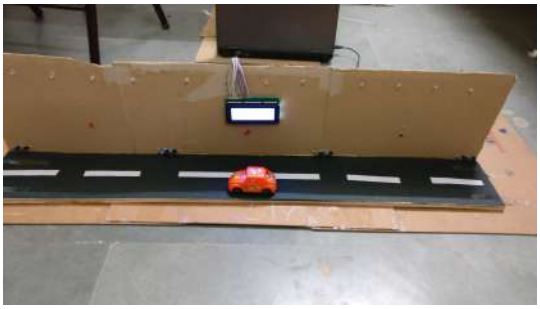

Fig. 7. Street lights off during day.

Fig. 8. Warning light glowing for overspeeding vehicle.

Fig. 9. Warning light glowing for overspeeding vehicle during day.

D. Overspeed Detection

As we did sense that there is obstacle comming inside the zone. Now, we have constant distance between two sensors and we also have time difference between start and stop sensing the obstacle of both the sensors, we can calculate the velocity of that vehicle. Now, we can set some threshold value of velocity in our microprocessor and if the vehicle passes with higher velocity than the specified value, it will give the command to warning light(Fig. 8 and Fig. 9) to glow giving the driver a message to slow down.

E. Outgoing obstacle

As IR sensors could sense that there is obstacle comming inside the zone in which the car is entered glows at 100% intensity and when the car goes to the next zone, Lights of the previous zone gets back to 20% intensity and the present zone glows at 100% intensity. As vehicle leaves last zone and suppose there is no any vehicle inside any zone, then all the lights og each and every zone will glow at 20% intensity

at night time.

F. Compute traffic and display

Fig. 10. Data records for traffic.

As we can calculate how many vehicles are passing through the road, microprocessor could store that data, could do the computation on it and show it. Here in our model, we are showing it on LCD display(Fig. 10) by using Arduino commands. Further, we can use it to do the maintanance of road so that road development department can give appropriate budget.

V. Experimental results an discussions

The above experiment gave the desired results and are described as follows:

Fig. 6 shows the car on street. When car is passing through the perticular zone of street(Middle zone in fig. 6), lights of that zone are glowing with 100% intensity and lights of other zones are glowing with 20% of intensity. Fig. 7 expalnes the condition at day time. At day time, there is a car shown in fig. 7, but lights of exery zone are off. Fig. 8 shows working of warning light at night time. Whenever car overspeeds, warning light glows. Fig. 9 shows working of warning light at day tme. As we see in fig. 7, street lights are not working at day time but we need to glow wrning light at day time also. Fig. 10 shows traffic data records. In fig. 10, there are four quantities displaying on LCD screen. 'Cars Passed': shows how many vehicles are passed through this road till now(From last reset). 'Speed Cars': shows how many vehicles have crossed the speed limit. '% Speed Cars': shows percentage of vehicles those have crossed the speed limit. 'Cars Inside': shows number of vehicles on the street at current condition.

VI. Conclusion

As our project is using a dark sensor to automatically switch the street lights, labor work is not required. During nights if we assume that a vehicles pass throught the street for 20 minutes in an hour (a rough estimate in practicle life) we will be able to save around 70% of the energy for 40 minutes in an hour which is a whole lot amount of energy saved. we are also keeping track of the number of cars entering the street which will give us an estimate of the rush on a particular street and will also tell us about the maintenence of the street and will also be helpful to the road development department to pass the budget acordingly for a particular region.

References

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[2] http://ecx.images-amazon.com/images/
[3] https://en.wikipedia.org/

Prosthetic Arm Prototype

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***Abstract*—We aim to explore the possibility of creating low-cost and high-functioning prosthetics for the physically disabled. The arm thus created, takes the input from the switches embedded inside the persons shoes/slippers and uses them to control the hand attached to the missing part of the forearm. The arm and the control circuit are connected via Bluetooth, hence making the device a cheap alternative against the commercially available EMG and EEG controlled alternatives. This first prototype can make different gestures using the thumb, index fingers and the rest three fingers coupled together. We this project, we aim that this prototype, after multiple improvements can one day, make its way into the hands of financially inept people with disabilities, even those residing in remote areas.**

I. Introduction

THIS project aims to provide for the people with non functioning forearms and with limited financial capabilities. This enables the person with non functioning forearm to control it forearm with his/her toes with the help of a remote control circuit attached to his/her shoes. This prototype uses a micro controller and servo motors to control the finger movements of the hand and the communication between the hand and shoe is done through bluetooth modules. Since this is a prototype it still has limitations but with enough budget and development and time these can be easily overcome.

II. Components Used in this Project

1) Arduino Uno ATmega328P(x2,Rs 370.00 per unit): A microcontroller, programmed by the user according to requirement. Receives input through analog and digital pins and then gives output through the digital pins based on the preprogrammed logic.

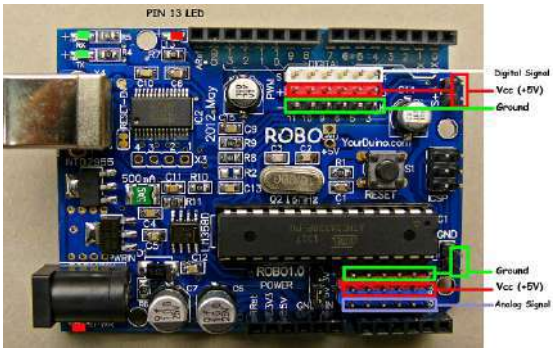

Fig. 1. Arduino Uno ATmega328P.

2) Serial Port Bluetooth Module (Master/Slave) HC-05(x2, Rs 390.00 per unit): The Bluetooth module, connected to the transmitter and receiver ports of the Arduino, used to transmit the input signals from the controller to the hand. This modules are based on the Cambridge Silicon Radio BC417 2.4 GHz Bluetooth Radio chip. It is a complex chip which uses an external 8 Mbit flash memory.

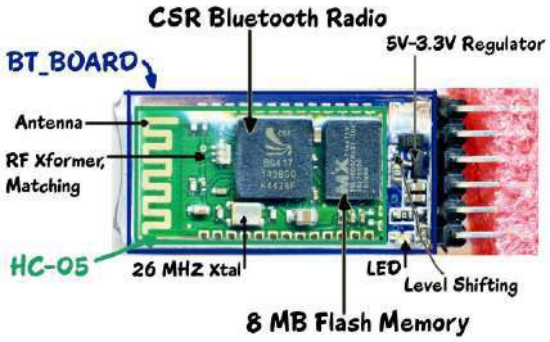

Fig. 2. Serial Port Bluetooth Module (Master/Slave) HC-05

3) Servo motors(x3, Rs 450.00 per unit): High torque 180 degree movement servos used to move the strings connected to the fingers for contraction and relaxation. Servos are small box-shaped electro-mechanical devices that contain a DC motor, electronics to control the motor from a signal, a gear system to produce slow/strong output to a shaft, and a position feedback potentiometer.

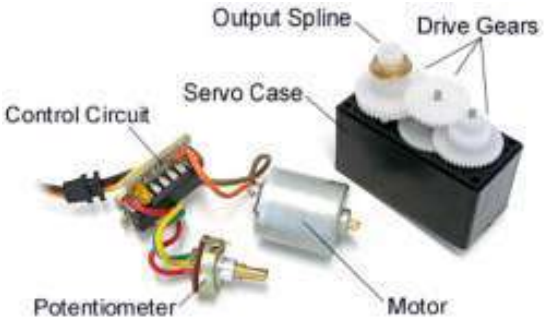

Fig. 3. Schematics and Different parts of The Servo Motors used.

4) Push buttons(x3, Rs 5.00 per unit)
5) Jumper wires(Rs 207.00 per a set of 120)
6) Breadboard(Rs 73.00 per unit)
7) Power supply: 9V Alkaline batteries(x2, Rs 20.00 per unit)
8) Cardboard and strings for the mechanical hand.

III. Basic Structure of The Device

A. Mechanical hand

A structure which serves the purpose of the hand and provides basic functions like gripping an object and gesture for pointing towards something. It consists of the palm and fingers made of cardboard with joints made of aluminium wires and plastic strings functioning as the muscle fibers. The index finger and the thumb are connected to individual servos while the rest three fingers are joined by a single servo motor for reducing the total volume occupied by servo motors since individual fingers are rarely used in the most common tasks like picking up an object.

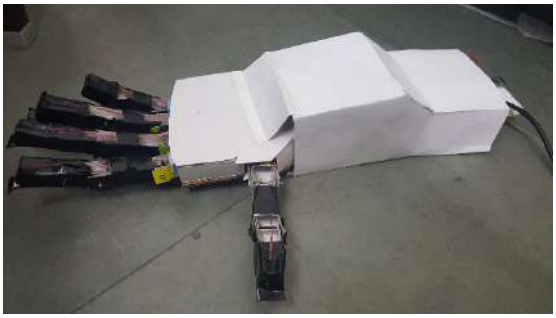

Fig. 4. The Mechanical Hand

Fig. 5. A single finger, highlighting the joints made of Aluminium wire and muscle fibres made of plastic strings

B. Transmitter circuit

A circuit attached to the footwear of the person, in which switches are attached to send signals to the hand via Bluetooth. There are push buttons acting as pressure sensors, the toes of the foot are to press those buttons to activate contraction of the fingers in the hand. The buttons and the Bluetooth transceiver (in master configuration) are connected to the Arduino Uno as shown in the following schematics.

C. Receiver and control circuit

Consists of a microcontroller (Arduino) and the Bluetooth module(in slave configuration) and the servo motors connected to it, which acts as the interface between the push buttons and the servo motors controlling the fingers of the mechanical hand.

IV. Highlights of the Prototype

A. Features

- The mechanical hand incorporates finger movement only, no wrist or arm movement.

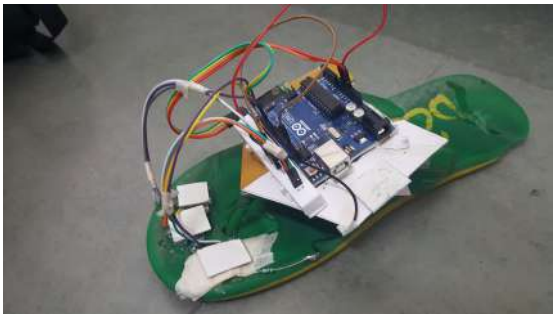

Fig. 6. The transmitter circuit in the footwear

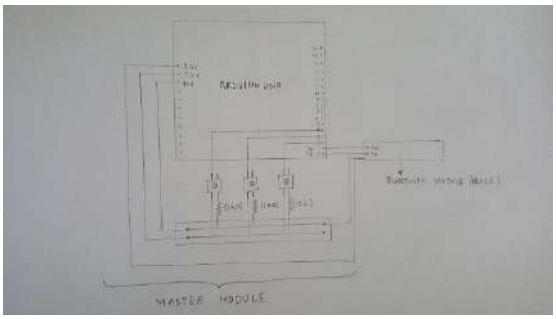

Fig. 7. Schematic View of the Master Module circuit placed in the shoe.

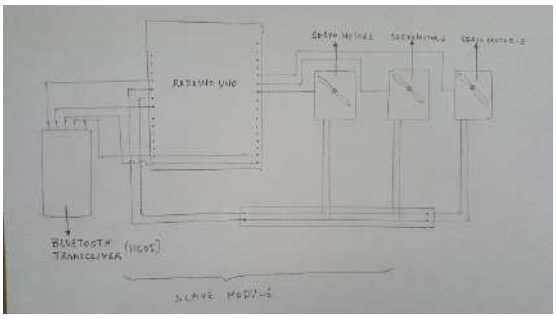

Fig. 8. Schematic View of the Slave Module placed in the Hand which controls the finger movements.

- There are 3 push buttons attached to the shoes each controlling one servo motor each.
- There are 3 motors one attached to thumb, second to index finger and other three to last motor.
- Hence we can generate the Pointing gesture, thumbs up gesture, grabbing action and OK sign by combinations of the push buttons.

B. Cost Effectiveness Of the Project

- Cost of the project - **INR 2900**
- 3D printing the entire structure: Cost will go up to INR 8000 (max.) since volumetric estimation of the structure gives cost of printing as Rs. 5000.
- Traditional prosthetic limbs in INDIA cost 10s of thousands, even lakhs, and although they have many desirable attributes, they lack functionality.
- Myoelectric sensors controlled prosthetics cost even more, and usually are imported from other countries.

- **Thus, we are reducing costs without hampering functionality.**

C. Advantages Of the Prototype over existing alternatives

- Most of the prosthetics in the market serve merely as placebos rather than providing any useful functionality.
- The working of the arm can become second nature over time. Doesnt require calibration
- The technologies used (e.g. Myoelectric sensors) used in the modern prosthetic arms are too expensive for the average man.
- The design is flexible, and the control circuit can be placed anywhere according to the users' requirement.
- The arm can be worn and does not need to be surgically attached.
- The design can be open-sourced so that people can recreate the device with available resources
- Since the mechanical structure is not permanent, it can be 3D printed and modified according to a persons needs
- The mechanical part can be changed in sized as a child grows up.
- **Low cost, doesnt require complicated machinery: - Can be made with very little expertise.**

D. Shortcomings and Limitations

1) The entire structure is made up of cardboard and hence has limited use right now.
2) The battery life of the hand and the transmitter is very low as currently we are using 9V alkaline batteries.
3) There is no feedback system to stop the contraction of fingers once an object is fully grabbed.
4) The transmitter circuit occupies a high volume and hence is difficult to be worn during day-to-day activities.
5) The hand has limited use while a person is walking.

E. People who stand to benefit from this project:

People with

- Amputated or non-functioning forearms.
- Limited financial capabilities.
- Residing in remote areas.

V. Future Plans and Developments for this prototype

- The hand can be 3D printed, so that we can scale and adjust the design for individual needs.
- The size of the circuits can be greatly reduced by printing the circuit boards.
- All the circuits can be waterproofed by encasing them with airtight gaskets.
- With an increased budget, we can incorporate more servo motors for individual finger movements and wrist movements rather than just hand gestures.
- We can also incorporate voice recognition, EMG(sensing of muscular contraction) and EEG(control using various centers of the brain) signal processing for the control circuit for accommodating different types of disabilities.

Fig. 9. Model of 3D-printed fingers (Open Source)

Fig. 10. Model of 3D-printed palm (Open Source)

Fig. 11. Model of 3D-printed wrist (Open Source)

Fig. 12. Model of 3D-printed Case for circuit (Open Source)

VI. Task Division and Individual responsibilities

- Lokesh Kumar: Concept design, Construction of the receiver circuit and assistance in transmitter circuit, Documentation, Procurement of components.
- Nadeem Qureshi: Concept design, Code creation for Arduino (both sensor and receiver), Construction of transmitter and receiver circuit, procurement of components.

Fig. 13. Model of 3D-printed Thumb (Open Source)

- Kumar Abinash Mishra: Construction of the mechanical hand, Sourcing of open- source STL files for 3D printing.
- Rijul Bathla: Construction of the mechanical hand, Procurement of components, finishing touches in the project.
- Ashish Meena: Help towards the Code creation for Arduino, General Contribution towards overall completion of the project.
- Suryakant Bhardwaj: Design of the mechanical hand, integration of transmitter with slipper, Procurement of components, finishing touches in the project.

VII. Conclusion

By this project, we set out to make an affordable and simple prototype of a prosthetic hand. In this endeavor, we faced quite some difficulties like reduction in size, cost control, balancing rigidity with the flexibility of finger joints, selecting suitable material for the hand for a proper demonstration, lack of experience in applied electronics etc. and we learnt how to overcome them by perseverance, trial and error and drawing inspiration from products made in earlier projects and by products already available in the market. We also learnt about Arduino and different types of sensors and actuators used with it and their applications, hence making this a learning experience from an electronics point of view, we also grasped the basic concept of working of the muscles in a human hand by trying to mimic it in this project. Finally, we hope that one day, this rewarding experience of ours will amount to something and after successive iterations, find its way to the physically disabled as a finished product.

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Pick and Place Robot

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***Abstract*—Nowadays, with the increase in population and needs of human being , speed in manufacturing and advanced technology are the basic requirements. Most industries are going to robotization. The concept of making this robot is to make a machine which adds an aid to human in most of daily work loads. Here, our project deals with an automatic arm which can be moved from one place to another. The plus point in our project is that it can be controlled manually through bluetooth, any person can control it as it is very easy to drive. It consists of a movable boat with arm and jaws. Jaws hold an object , arm lifts it and the boat moves the entire body from one place to another. We can modify our project to deal with large scale. Some of the main applications are Mechanical workshops, industries and households.**

I. Introduction and motivation behind the Project

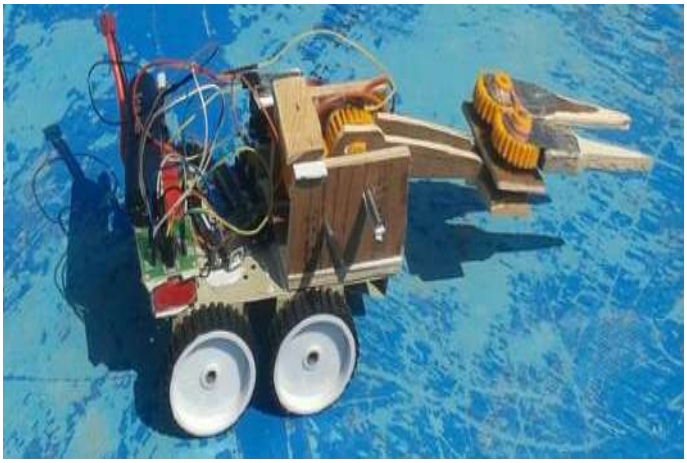

Fig. 1. Our Project

Our Pick and place Robot consist of 4- stepper motors and 2- servo motors with a battery and motor driver and an arduino. Battery, arduino and servo motor are placed on the chassis of the boat. The 4- stepper is attached with wheels of the boat. Motion of the boat is controlled by individual rotation of stepper motor.eg, if both the stepper motors of left side is in a rest condition and stepper motor of right side is in moving condition then our boat will move in the direction of left or right depending on the direction of rotation of the motors.

- Motivation behind the project

It can be widely used in Land-slide. It can be used industries on large scale for assembly,process automation,welding. Hazardous Environments such as defense area to diffuse bombs etc. Space exploration. Medical applications - such as surgical operation where it can perform operations with more precision and accuracy. Oil refineries. Also, can be used as a good teaching aid.

Fig. 2. Some applications

II. Requirements

A. Consist of following electrical components:

1) *Servo-2 and Stepper motor-4:*
2) *Motor driver L293D-1:*
3) *Arduino UNO-1:*
4) *Bluetooth Module HC-05-2:*
5) *A battery (rating is 12 volt) and a power bank:*
6) *Jumper wire:*

B. And mechanical components are following:

1) *Chasis:*
2) *Wheels-4:*
3) *Arm(made of wood) and base of arm:*
4) *Two jaws (base supporting jaws):*
5) *Gears(4) and axel:*

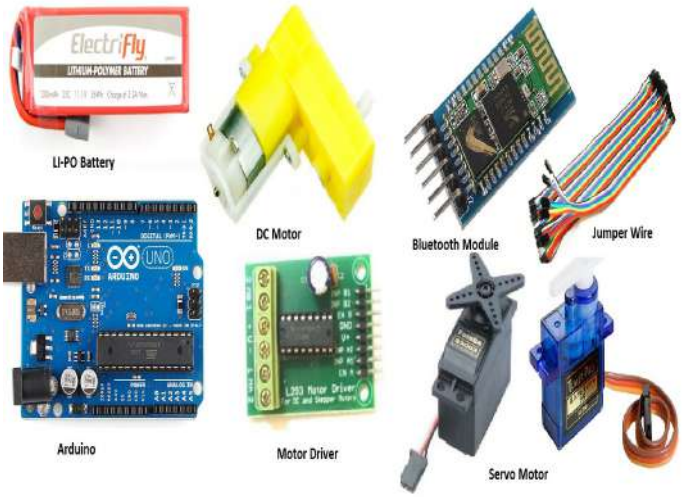

Fig. 3. Components

III. Discussion and Result

First , we set all the 4 wheels using 4 DC motors separately for each wheel in chassis. We connected each pair (left or right) of wheels to the arduino analog pin. We used motor driver to amplify the signals sent by arduino to the motors as per the desired speed. A bluetooth module is connected to arduino which can be used to receive signals from the user(mobile application) and transmit it to the arduino. Arduino receives the signals and according to the signals it gives instruction to the motors ,thats how it controls the motions. Basically, robot has 4 motion i.e forward ,backward,left and right and two motion to lift an object i.e up and down.

We have designed the whole system of arm in mechanical workshop using various components and machines present there. We have used 3D printer to print two axes which are fitted in gears and motors simultaneously.

- Arm and Jaws are made using playwoods and sheet metals. System of arm and jaws has two motions i.e vertical and horizontal. The motion are given to arm using combined system of gears and servo motors.

All these functions are controlled by a program whose code is fed in the arduino as per user instructions(requirements).There occurs a communication between bluetooth module and arduino. The connection between arduino and bluetooth module is based on TTL logic. Rx and Tx pin of bluetooth module are connected to Tx and Rx pins of arduino respectively. Power is supplied to the bluetooth module from arduino 5V pin.

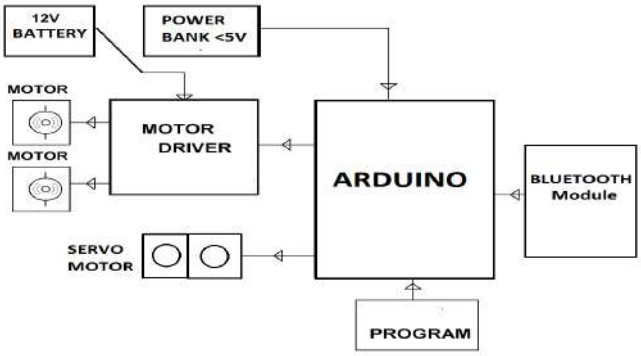

Fig. 5. Design

Bluetooth module is paired with the bluetooth of mobile to communicate with the bluetooth controlled mobile application. Rx and Tx signifies receiver and transmitter of signals respectively. Instructions received to the bluetooth module is transferred to the arduino.

In mobile there are various buttons for various functions.

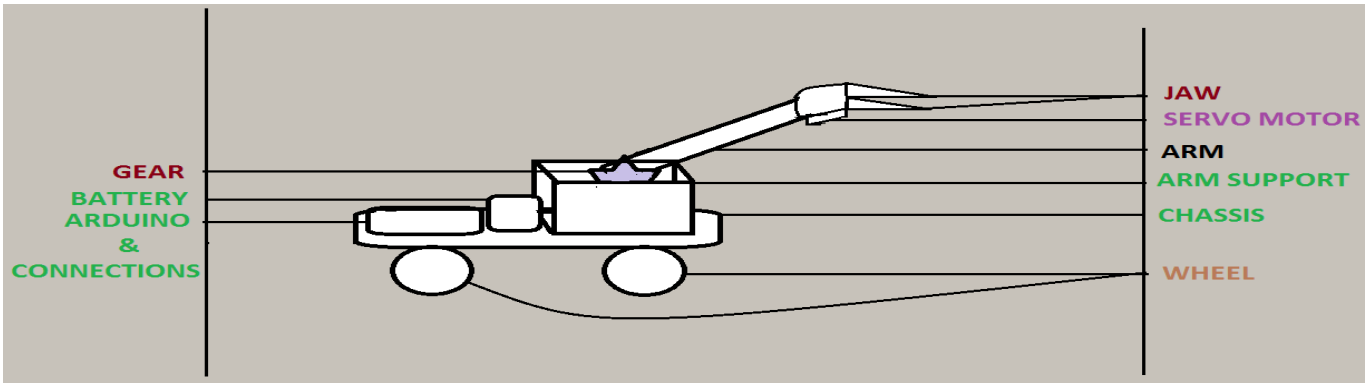

Fig. 4. Logic Behind Control

For example, if we press forward button then 'F' signal is transmitted to the bluetooth module and then it sends the signal to the arduino. In the code for 'F' signal a function is made in which all the motors are given the command to move forward(clockwise).

Similarly, if we press the backward button then 'B' signal is transmitted to the bluetooth module and then it sends the signal to the arduino. In the code for 'B' signal a function is made in which all the motors are given the command to move backward(anti clockwise).

-For side ways motions
If we press the left button then 'L', signal is transmitted to the bluetooth module and then it sends the signal to the arduino. In the code for 'L' signal, a function is made in which the motors at right side are given the command to move clockwise and motors at left side doesn't moves.

Similarly, if we press the left button then 'R' signal is transmitted to the bluetooth module and then it sends the signal to the arduino. In the code for 'R' signal a function is made in which the motors at left side are given the command to move clockwise and motors at right side are stopped.

Fig. 6. Mechanical Arm

-For controlling arm and jaws...
If we press the forward-left button then 'G' signal is transmitted to the bluetooth module and then it sends the signal to the arduino. In the code for 'G' signal a function is made in which the servo motor connected to arm is rotated 45° anti clockwise direction(i.e arm is lifted upward).

If we press the forward-right button then 'I' signal is transmitted to the bluetooth module and then it sends the signal to the arduino. In the code for 'I' signal a function is made in which the servo motor connected to arm is rotated 45° clockwise direction(i.e arm is pulled downward).

If we press the back-left button then 'H' signal is transmitted to the bluetooth module and then it sends the signal to the arduino. In the code for 'H' signal a function is made in which the servo motor connected to jaw is rotated 60° anti clockwise direction(i.e jaw is moved outward).

If we press the back-Right button then 'J' signal is transmitted to the bluetooth module and then it sends the signal to the arduino. In the code for 'J' signal a function is made in which the servo motor connected to jaw is rotated 60° clockwise direction(i.e jaw is moved inward).

IV. Conclusion

Fig. 7. Sensor

Since, it is controlled through bluetooth by application, so for advancement we can make it self-controlled i.e autonomous. In order to make autonomous , we have to use UR-sensor. from UR-sensor we can detect object placed nearby the boat. Basically, UR sensor emits the ultrasonic rays continuously whenever there is an obstacle in front of the robot then the rays is reflected back after striking to the object. The reflected ray is received by the receiver of UR sensor. Using the speed of sound in air i.e 340 m/s, it gives the total time, so that we can calculate the distance and accordingly set the instruction to the robot. Apart from this, we need to feed the map of required road in the code so that robot can recognize when it has to take left turn ,right turn or move forward. - In this way we can reduce man power.

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[1] Figure of components (fig.2)
Arduino -:$https://cdn.sparkfun.com/assets/9/1/e/4/8/515b4656ce395f8a3$
Li-Po Battery:-$http://www.robotshop.com/media/catalog/product/cache/1/i$
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[3] Figure used in Fig.6
Sensor :-$http\ :\ //ecx.images-amazon.com/images/I/51-kMqz1E1L._SL.jpg$
[4] details of coding related to arduino
https://www.arduino.cc/

SMART STREET LIGHTs

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I. Objective:

The sole objective of this project is to save energy used in street lights in unnecessary times. Smart Street Lights will be very helpful in such areas where there is a very small traffic in night time, but street lights are always on.

II. Abstract

A lot of electrical power of the world spend in street lights. But we can save a big part of this power by implementing the idea of automatic street lights. In day time, tratditonal street lights are ON unnecessarily. And sometimes there is a lot of fog in winter, and these are off during day times. But in dense fog and cloudy weather, we need lights as sunlight is very less. These problems can be overcome by using Smart Street Lights.
These street lights work according to the surrounding environment.
(1) According to intensity of light falling on Light Dependent Resistance(LDR).
(2) According to the object passing through the region or by using IR object Sensor.

III. Introduction and Motivation of the Project

One of the most important task of any civilisation is the transportation of goods and travelling across the cities. So roads are very much used for this purpose, and in nights street light consumes a lot of energy.
We need to conserve energy because most of the energy resources we are using today, like coal, pertroleum and natural gases are non-renewable.

We can surely do two things;
1. We can discovver new energy sources.
2.We can conserve energy, used in unnecessary times.

So lights should be switched off when not in use. Here, we are providing the solution to the problem by an automatic street light system.
There is a sifnificant power loss in traditional street lights. Smart Street Lights overcome on the difficulties and restrictions with the old type street lights. These are very effective and extremely dependable. Automation is done to decrease the labour, as people has gotten very busy, even to find the time to switch off the lights.

This system works in to two ways-

According to intensity of light:
As the light(sunlight, etc.) falls on LDR, then a voltage difference is generated across LDR. This voltage is used by arduino and with some programming, LEDs intensity is controlled.
If Incident light intensity is high enough, then LEDs are OFF otherwise LEDs are ON , and LEDs' light intensity varies with incident light intensity.

According to the object passing through the region:
We have put some IR object sensor in front of some lights. These sensors are used to identify the object which is passing through front of it. Whenever an objects passes it give command to street lights to ON.

IV. Requirements

Hardware Components
1.LDR Sensor
2.Jumpers
3.LEDs
4.Battery(9 Volt)
5.Double Sided Tapes
6.Breadboard
7.IR object Sensor
8.MOSFET
9.Arduino UNO

Arduino IDE is used for Arduino programming.

V. Component Details

LDR Sensor:
Light Dependent Sensor or LDR is a device whose resistivity is a function of the incident electromagnetic radiation. There is an inverse relation between resistance of LDR and intensity of incident light.
They are made up of some semiconductor materials having high resistance. An LDR works on the principle of photo conductivity.

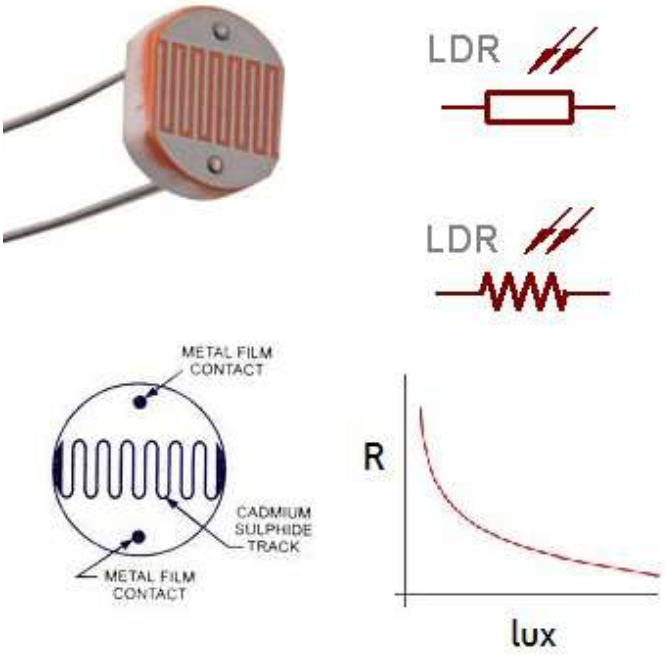

Fig. 1. LDR Sensor

Fig. 2. IR Object Sensor

Fig. 3. n MOS

IR object Sensor:

The Main Concept of this sensor that the IR led transmits IR infrared rays . The wavlength range of infrared rays is roughly 0.75m to 1000 m. These are invisible to human eyes. When some object comes in the (IR) infrared range, the IR waves hits the object and comes back at some angle, The Photo diode next to IR led detects that IR infrared rays which got reflected from the object.

Arduino UNO:
Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button.

MOSFET:
The metal oxide semiconductor field effect transistor is a type of field effect transistor(FET). It has an insulated gate, whose voltage determines the conductivity of the device. This ability to change conductivity with the amount of applied voltage can be used for amplifying or switching electronicsignals.

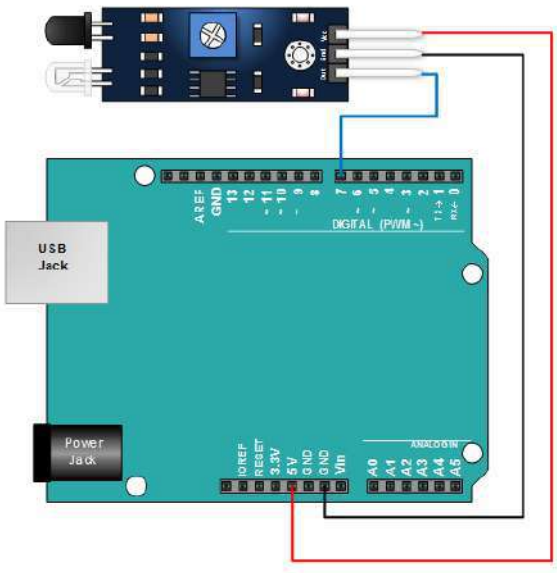

Fig. 4. Arduino Connection with LDR Sensor

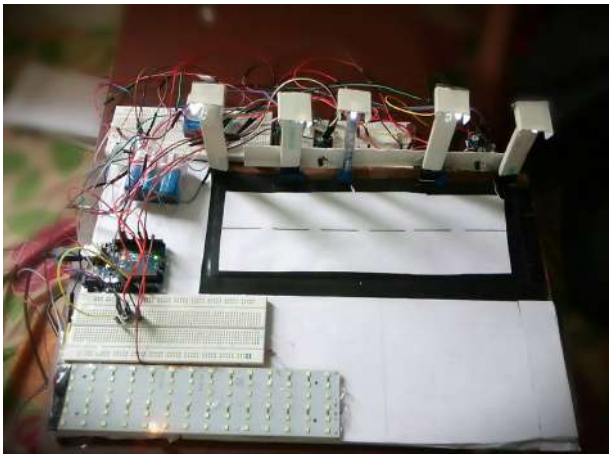

Fig. 5. Project Photo

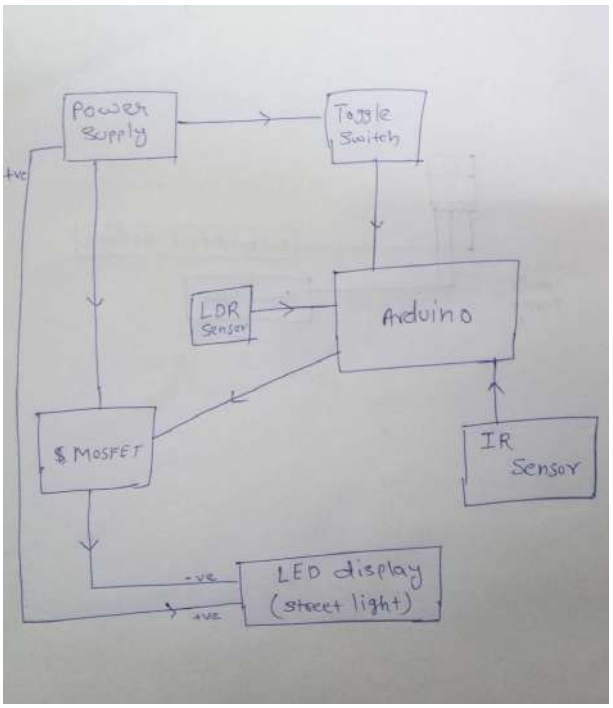

Fig. 6. Block Diagram

VI. Project Description

Arduino UNO board has six analog to digital converter channels. They can only measure voltage.But resistance can be measured indirectly by converting it into voltage form. This is often called as 'Signal Conditioning'. 4.7K ohm resistor is used in series with LDR through 5 volt source.

LDR sends some value of analog voltage which is converted into an particular analog value. Analog value varies from 0 to 1023. According to values we have set a particular value of brightness.

VII. Applications

In modern times of automation, Smart Street Lights have many applications.
1.It can be used at roads which is less often used.
2.On National Highways
3.Room Automation

VIII. Results

There are two cases in this project.

Case 1: If IR sensor senses the object.
When an object is passed in front of the IR sensor, an analog output generates which is sent to the input channel of the arduino. And with some programming in arduino, sufficient insity of light is achieved. Thus, power is mostly only used when there is an object passing the road.

Case 2: If IR sensor does not sense any object.
When no object is passing in front of IR sensor, no analog output is generated. And hence light intensity is very less, saving a lot of power.

IX. Conclusions

The idea of this project can be implementes in many cities, where a lot of electrical power is consumed in street lights. This can be a step to systemise the use of power consumption and hence saving a lot of power. These lights are the one time investment, and after that we can always save the power. Our nation can have a good electrical efficieny by the systemetic use of electricity.

X. Reference

All images has been taken from google, except block diagram.

Aavishkar'17
Autonomous Fire Extinguisher

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***Abstract*—In Aavishkar'17, we chose Autonomous Fire Extinguisher as our project for IC-161P. The idea behind making this Autonomous Fire Extinguisher was to save the lives of the affected and the rescuers in the time of calamity. We aimed at making a fully autonomous robot which could independently detect fire in its surroundings and extinguish the fire on its own. The desired task was completed successfully and it was successfully demonstrated amongst the audience and the judges in the Open House held for Aavishkar'17 without any flaw or failure.**

I. Apparatus Used

Sheet metal $(0.6\ mm)$, 4 x 300 rpm Gear motors, 4 x Motor clamps, $1.25''$ diameter PVC pipe, 2 x PVC Tee joint, 1 x 200 rpm Johnson Motor, 5 x 10 cm wheels, Nylon belt, Fire Extinguisher (Foam), Arduino Uno, Bread Board, 2 x Motor Driver, 2 x Flame Sensors, $12V$ Battery, $5V$ Power Bank, Double sided tape, $M-M, M-F, F-F$ connecting wires, USB - OTA cable.

II. Introduction

AUTONOMOUS Fire Extinguisher, the Aavishkar'17 project for group no. 24 aimed at saving lives in the distress and disaster.
Under the circumstances of calamity, Autonomous Fire Extinguisher will prove as a valuable resource by providing an autonomous support to the rescuers and the deceased in times of fire calamity. The Autonomous Fire Extinguisher is programmed to automatically detect fire, locate the fire and extinguish the fire using the fire extinguisher installed on it.

The benefits that Autonomous Fire Extinguisher provides are

- **Utility :**
  If implemented carefully it can be very useful as it can reach the place of calamity automatically and quickly.

- **Need :**
  Prevents deaths of Firefighters and increases the accessibility to threat areas.

- **Portability :**
  It is small, compact and portable and hence can be carried and utilised in places of all sizes.

III. Current Scenario

Fighting against fire is no child's play and it takes deep courage to do so. But at the same time it is also very risky to jump into open fire for the fire fighters and at most times it is a question of life and death.
Following table shows the fatalities caused to the Firefighters in USA in one single year : While these are the stats of only Firefighters in a well developed country, the number of casualties vary form place to place and increase as the resources decrease, still the count of people who left their lives to fire remains undiscovered.

Serial No	Cause of Injury	Fatalities	Percentage
1	Medical/Stress/Overexertion	40	59%
2	Crashes	8	12%
3	Struck by object	6	9%
4	Fell	4	6%
5	Rapid fire progress/ explosions	1	1%
6	Lost inside	1	1%
7	Caught underwater	1	1%
8	Fatal assault	1	1%
9	Structural collapse	6	9%
Total		68	100

Fig. 1. Causalities pertaining to cause of injury

IV. Proposed Solution

We plan to make a fully autonomous robot which would be able to detect and locate fire and take actions to extinguish

the fire. The only thing that the bot would need would be to physically present at or in the surrounding of the area affected by fire. Our bot would be able to extinguish fire wherever it senses fire, move towards it and then extinguish till all the fire has been extinguished.

Fig. 2. Actual Photograph of the Fire Extinguishing Bot

V. DESIGN

It works on the principle that fire as a source of heat emits infrared radiation. These infrared radiations can be detected and there source can be located in order to detect the source of fire.
The Arduino Uno installed in the bot acts as the brain of the robot. All the mechanisms are connected to the Arduino for processing of inputs and getting further instructions.

A. *Structure*

The basic structure of the robot consisted a chassis and a set of four motors for locomotion. Further a pipe was attached to the chassis in order to hold the fire extinguisher at its place. A mechanism for spraying the fire extinguisher was mounted on the top of that pipe. Flame sensors, Aurduino Uno, Bread Board, Batteries, all these were mouthed on the chassis.
The proposed structure of the robot looked like :

We made a chassis of dimension $30X25\ cm^2$ and placed 4-L clamps to place four 300 rpm (revolution per minute) gear motors to provide locomotion. These motors were connected to a motor driver which was connected to a battery source and aurdino. The battery, powerbank, aurdino, bread board were mounted on the rear side to balance out the weight and torque. One flame sensor (S1) was placed in front of the bot to detect flame along the line of sight of bot. The fire extinguisher was mounted on the pipe and a mechanism was established on top of the pipe. The mechanism consists of a 200 rpm johnson motor set up on the pipe. The motor had a wheel and a strap which passed over the top of the fire extinguisher's nozzle. When the motor rotates, the strap tightens and the nozzle is pressed and the foam comes out of the fire extinguisher. The

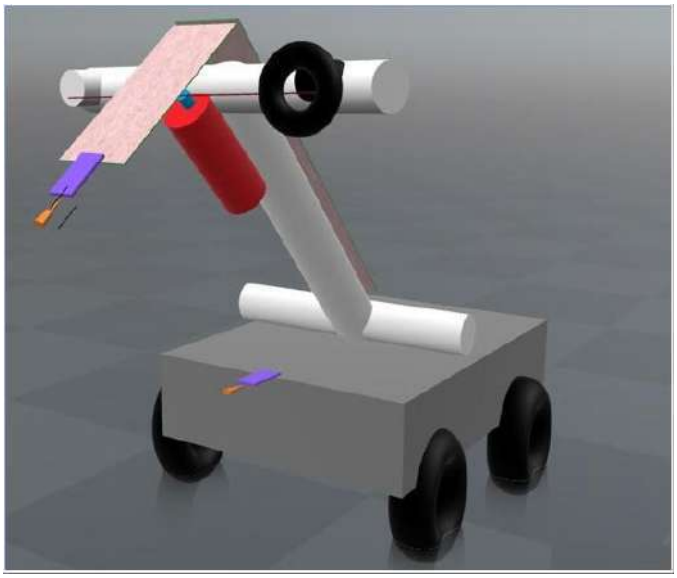


Fig. 3. CAD model of the robot

decision to fire the fire extinguisher is taken by another flame sensor(S2) mounted on the top of a platform just above the fire extinguisher. The flame sensor S2 aims at the target of the flame extinguisher. When both the flame sensors detect fire, only then the fire extinguisher is fired and the fire extinguishes. Sensor S1 guides the bot to rotate in the direction of flame whereas sensor S2 moves the bot closer to the flame up to the point it is supposed to start the fire extinguishing mechanism.

B. ***Code Explanation*** *: Routines and Flow Chart*

- **sweep**:
  - **Role:**
    To sweep across an angle of 180 degrees in front of the bot and simultaneously check for fire detection in sensor S1, to stop the bot at the instant the S1 detects fire and exit the function.
  - **Working:**
    Rotate the bot 90 degrees clockwise. Then rotate the bot 180 degrees anticlockwise and again 90 degrees clockwise. During this time, keep the sensor S1 active and return the function when sensor S1 detects fire.(Refer Fig: 4)
  - **Return Type:** int
  - **Return Value:** 1 if fire detected, 0 if fire not detected
- **detected**:
  - **Role:**
    To keep moving forward in the direction in which sensor S1 detects fire untill sensor S2 detects fire, i.e, fire extinguisher now aims at the flame.
  - **Working:**
    Mve the bot forward 1 step, then check for fire in S2. Keep doing this till S2 detects fire. Call the **extinguish** routine thereafter.(Refer Fig: 5)
- **undetected**:

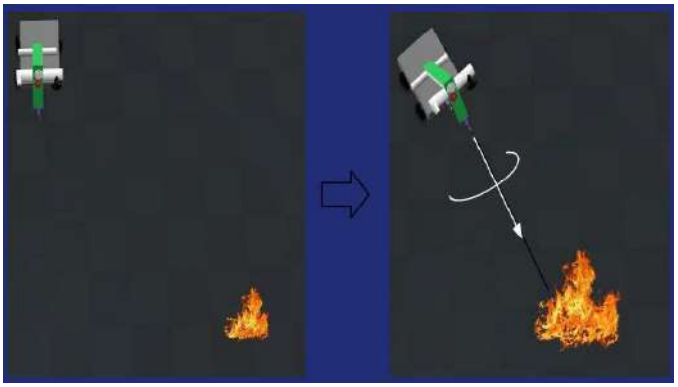


Fig. 4. Representation of movement of bot in sweep routine to detect fire

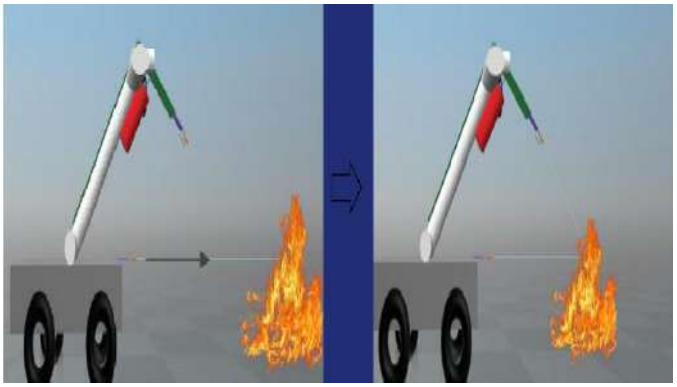


Fig. 5. detected routine: The bot approaches the fire till sensor S2 detects fire

  - **Role:**
    To move forward to enter a new range to detect fire along sensor S1.
- **extinguish**:
  - **Role:**
    To activate the fire extinguishing mechanism and extinguish the fire.(Refer Fig: 7)
  - **Working:**
    Rotate the wheel anti-clockwise for 3 seconds. Hold the condition for 2 seconds and rotate again in clockwise direction for 3 seconds to go back to initial state.(Refer Fig: 6)

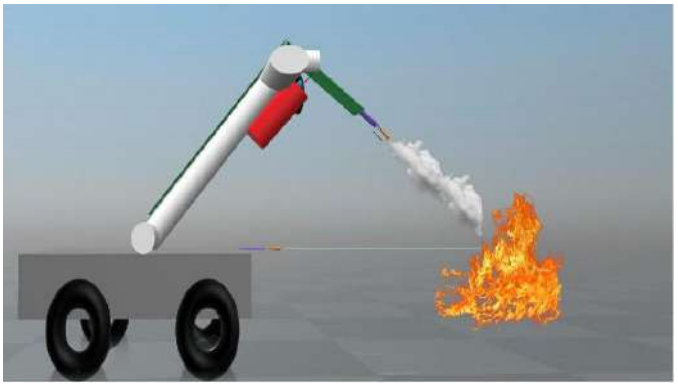


Fig. 6. extinguish Routine: Side View

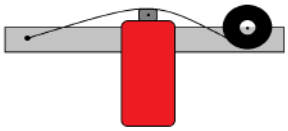
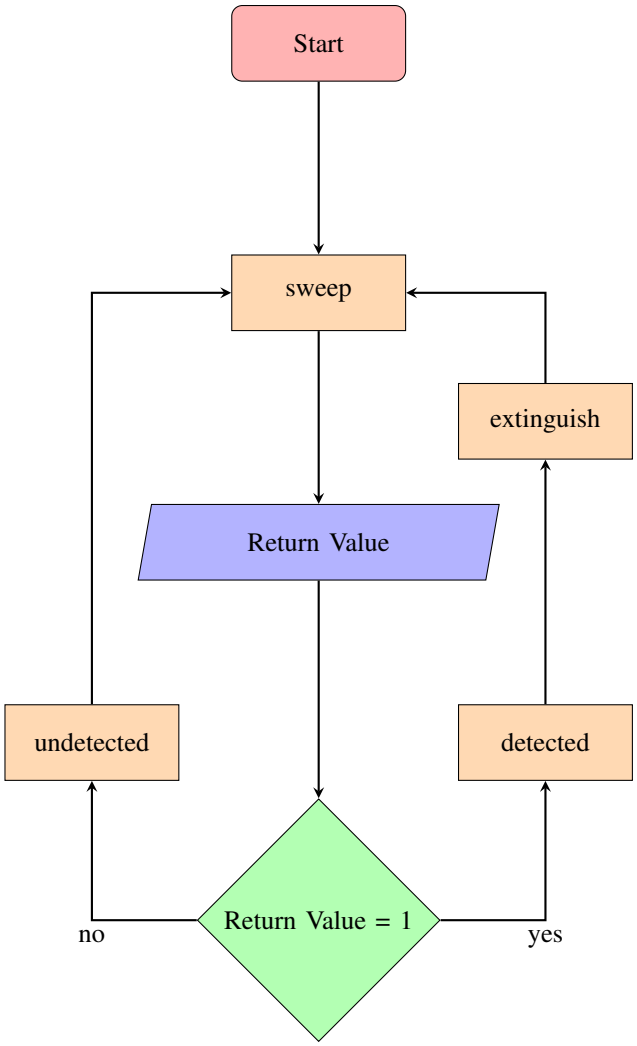


Fig. 7. Diagrammatic representation of front view of Fire Extinguishing Mechanism



VI. Limitations

Following are the limitations that our robot possesses due to financial limitations :

- **Restricted to low sunlight areas :**
  As we are aware of the fact that sunlight contains infrared radiations too, the flame Sensors when exposed to sunlight detect infrared radiations and give a false positive response for fire.
  So if the place where the robot is present is a rich sunlight place, then the robot might detect false fire.

- **Extinguishes ground fire only :**
  As the fire extinguisher is fixed and we do not have any mechanism rotate the arm containing the fire extinguisher, we are restricted to only detect ground fire and extinguish. Our robot wont be able to deal with wall and roof fires.

VII. IMPROVEMENTS

Following are the improvements that can be made:

- **Image Processing :**
  Visual input could be taken and processed upon to segregate the infrared radiations coming from the fire and various other sources.

- **Extend Capibilities :**
  We plan to make the robot able to deal with roof and wall fires as well. With addition of this feature, our robot would be able to tackle fire of any type.

- **Alerting :**
  We plan to install a alarm mechanism linked to a control center where the robot can autonomously report fire and alert the required persons about whereabouts of fire.

- **Sonar :**
  We plan to make the robot overcome obstacles on its own by installing sonar sensors to sense obstacles.

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Aavishkar 2017
Automatic Irrigation System

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***Abstract*—The objective of our project is to detect soil moisture level in the fields and maintain it at an optimum level.**

Recently, there has been a sharp decrease in the availability of labour force in agriculture and farmers are now heading towards automated systems. This project is an attempt in the direction to providing an easy and cost effective solution to automated irrigation. The data received from soil moisture sensors, coupled with information of water level in the tanks is processed to trigger the operation of the water pump (turning it on or off). The microcontroller used for achieving our objectives is arduino. An android app has also been integrated with the system

Our solution is not only limited to agricultural fields, but can help in the maintenance of gardens, lawns and balconies in urban areas as well.

I. Introduction

The agricultural sector is fighting against too many foes in the present world for its mere survival. Its time that technology, the prime deciding factor of the fate of virtually anything in todays world, extends its benefits to this crucial sector as well. Ours is a small effort motivated by and directed for this cause.

We have designed an automatic irrigation system, that operates on the basis of data collection, soil moisture level and water availability.

Soil moisture sensors, plugged into soil at different points in the field, returns quantitative data of the moisture level in the soil. This data is processed against a pre-fed data of optimum moisture level within an Arduino and the further course of action is determined based on the comparative results. This pre-fed data is based on optimum moisture levels for different crops in different conditions as recommended by the Indian Agricultural Research Institute [4].

Parallelly, information regarding the availability of water in the source tank (in case the water is taken from a tank or equivalent structure) is fetched via a float switch fixed to water tanks, which helps indicate the water level in these tanks. If the moisture content in the soil is below the required/optimum value, and water is available for irrigation, the Arduino microcontroller switches the water pump on, and water is supplied to the required area. However, if the water level in the tanks is indicated to be low, no water will be pumped to the field, irrespective of the moisture content in the soil, thereby preventing any undue damage to the water pump. The soil moisture percentage, the water level and the pump status are very clearly indicated on a LCD screen that has been set-up alongside this entire system. Additionally, a Bluetooth module also sends this data to a calibrated android app on a mobile phone, and thus the data and process may be monitored by the user at all times and from anywhere. To add to these features, two LED lights, serving as simple indicators of the soil moisture level (red) and tank water level (blue) for the illiterate have been paired up with the system. Moreover, the circuit checks moisture level during the time motor is on. If the moisture level reaches an optimum level, motor automatically turns off.

II. Details of devices and apparatus used:

A. Soil Moisture sensor module:

Fig. 1. LM393D comprator module

Fig. 2. Moisture Sensor Probes

Operating and principle

- The soil moisture sensor used in this project is LM393D [1] comparator based moisture sensor. It senses volumetric moisture content of water present in the soil using resistance (and hence the potential difference) between its two probes.
- The voltage data is sent to comparator circuit where it is converted to return value in the range of 0 to 1023 [1].
- This value is received at arduino pin number 1 for further processing.

B. LCD Module

Fig. 3. LCD Module

1) About device:

- A 16X2 JHD162A LCD(liquid crystal display) [2] device was used.
- It has 16 pins. We used it in 4 bit operation mode to display the status of soil moisture, tank level and pump status.
- An already avaliable arduiono library LiquidCrystal.h was used to interface LCD with the main circuit.

C. Float switch water level detector

Fig. 4. Float Switch

1) About device:

- A magnetic conduction based float switch was used to monitor water level in the tank.
- It has a drum like floating part which when pushed upwards by water gets attached to upper bar conducts electricity and sends a HIGH signal and does not conduct when it is resting over the lower bar.
- When the switch conducts, HIGH signal is obtained, when it does not conduct, LOW signal is is obtained at arduino.

D. 9 V DC water pump circuit

Fig. 5. Submersible Pump

1) About device:

- A 9 V (volt) submersible pump [7] was used to demonstrate water flow to the field. Along with it, a L293D moter driver IC and a (V battery were used as auxiliary components to drive it.
- A HIGH command to motor driver is used to run motor and LOW command is used to stop the m otor.

E. Arduino UNO R3 board

Fig. 6. Arduino

1) Operation:

- An arduino board [3] was used to control and give instructions to the components of the circuit. It makes use of ATmega328P to control commands. It has 14 digital and 6 analog input/output pins to connect it to other components of circuit.
- The programming language used to give instructions to it is in the form of C/C++. Pre generated libraries which contain function prototypes are available for it.

F. Bluetooth Module and android application:

Fig. 7. HC05 Bluetooth Module

1) About the device and app:

- A HC-05 Bluetooth module [2] was used in the circuit to communicate between arduino and the android device to send data on soil moisture percetage, liquid level in the tank and pump status.
- Bluetooth module operates on the principle of radio waves to provide a wireless connection withion the range of 30 meter. Android app used for receiving data is ArduTooth, which is available freely on Google PlayStore and can be easily modified to suit the requirements of the user.

III. CONNECTION PROCEDURE

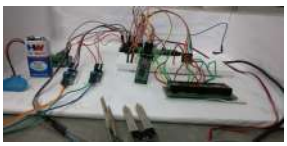

Fig. 8. Final System

TABLE I
PINS OF ARDUINO USED TO CONNECT DIFFERENT COMPONENTS

Device	Pins used
Soil Moisture Sensor	A0
Float switch	A1
Motor Driver	A4,A5
LCD Module	pins8,9,10,11,12,13
Soil Status LED	4
Tank Status Led	5

A. *Interfacing of the circuit*

first of all, the soil moisture sensor was connected to the arduino. Then wires were soldered on pin numbers 1,2,3,4,5,6,11,12,13,14,15,16 of LCDE display module. Then pin numbers 1,3,5,16 (with a 330Ω resistor in series) to ground. Pins 2,15 were connected to Vcc (5 V), rest of pins were conected in series to pins 13,12,11,10,9,8 of arduino. For interfacing float switch with arduino, A1 pin was used to receive input and other terminal of float switch was grounded. Status indicator LED's were connected to pins 4 and 5 of the arduino with 330Ω resistors in series with them. Submersible pump was connected to the motor driver at motor 1 slot. pins A1 and A0 of motor driver were connected to A4 and A 5 of arduino. A 9 V battery is connected to motor driver to power the pump externally. Finally, the bluetooth module is connected to the arduino by connecting pin Tx to 1, Rx to 2, Vcc to 3.3V and GND to Ground.

For avoiding interference between the signals of soil moisture sensor and LCD module, a seperate ground is created for the pins of LCD.

B. *Writing code and optimising bluetooth app*

Fig. 9. A code snippet

For writing instruction code, arduino IDE (integrated development environment) software is used. The code is written using arduino programming language language and pre available arduino libraries LiquidCrystal.h and SoftwareSerial.h are used.

The android app contains a section for modifying it according to the format of output. Since we are displaying three output values and tha app is programmed to display 10 output values, we reduce the number of outputs to 3. The string display is also incorporated to show words 'HIGH' and 'LOW'.

IV. DATA ON OPTIMUM SOIL MOISTURE AND CALIBRATION OF THE SENSOR RETURN VALUE

This is most important part of this system. Since different crops need different levels of soil moisture for optimum growth, accurate calibration of moisture sensor according to different crops occupies paramount importance. The return value of moisture sensor is from 0 to 1023. map() function of aduino programming language is used to convert these values in the range of 0 to 100 percent. Data of volumetric moisture level requirement of some major crops for their growth period is collected. This data is divided by growing period to find the optimum moisture percentage required. Then, return value is taken and mapped according to required threshold moisture. This sets corresponding return value threshold. The table for reference is attached below:

TABLE II
OPTIMUM MOISTURE AND RETURN VALUES

Crop name	Percent Moisture	Return value
Rice	70	309
Wheat	40	610
Barley	38	620
Maize	56	450
Jute	60	410
Suger cane	5	
Coffee	30	718

V. WORKING OF THE CIRCUIT

The following flow diagram explains working of circuit in different situations:

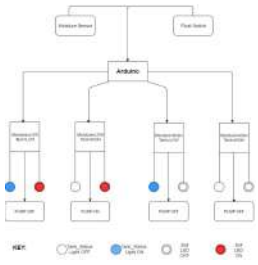

Fig. 10. Flowchart explaining working of circuit in different conditions

VI. POTENTIAL AREAS OF APPLICATION

- This system can be very much useful for the farmers who grow only one crop for a particular season. The watering system can be automated fully by installing this system.
- This system can also be useful for the agricultural researchers who collect data on soil moisture levels in different soils and regions.
- Plantations like apple, almonds, cardamom, other spices, saffron, etc. can be automatically irrigated using this system. The problem with these type of plantations is that monitoring of each and every segment is done manually. This system, once installed will relieve this burden of doing monitoring manually.

VII. RESULTS

- The cost of whole system with the protective case is Rs. 1650.

- The model designed by us work efficiently for 12 X 8 sq. feet.
- We set the delay of 5 seconds while reading data from soil moisture sensor so that we get correct and stabilize data.
- System can be used to work with different crops by setting threshold value of moisture accordingly.

VIII. CONCLUSIONS

- In areas of high undulating terrains water gets accumulate at lower level more as compared to upper level so depending on positioning of soil moisture sensor we will not be able to collect correct data of moisture [5].
- Due to limitation of pin inputs available on arduino, only one soil moisture sensor could be included. This limitation can be overcome by using any other micro controller which has provision of taking more inputs than arduino.
- This system can be very efficiently used in urban areas households where there are small gardens and plants are grown in small pots so every pot has separate soil moisture.
- Presently, the threshold values of soil moisture are hard-coded for different crops. We can modify the app so that the threshold values of soil moisture can be set dynamically.
- If solenoid valve is included in the circuit, the flows to different directions can be channeled (if a drip system is used) or different sprinkles could be turned on depending upon where moisture is less and where it is high.

IX. DISCUSSIONS

Different soil types and regions will have different data sets wrt the optimum moisture level required for different types of crops. The data sheet attached with this report contains this information for the regions of Eastern Rajasthan and Western Madhya Pradesh. This is what our product has been configured for. As the region and conditions (and thereby the dataset) vary, the same maybe reconfigured via simple changes in the arduino programme to suit the new requirements [4]. A single soil moisture sensor can accurately return results for an area of dimensions 9X9m^2 (measured at football ground of IIT Mandi). For larger fields, multiple soil sensors can be used and for differential watering in these regions, a solenoid valve can be paired up with our system, to channel flow in different directions. The indication of data via LEDs, LCD screen, and mobile app ensures easy understanding of the system status by users.

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3D PLOTTER :

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***Abstract*—The Objective is to calculate the mass or weight of the soil/ material falling in a Landslide (contact slide). In this project using Sonar sensor to calculate depth at each point and make a matrix containing data obtained by experiment.**

I. MOTIVE:

The motive of our project is to facilitate the post landslide study by providing an easy and economical way of collecting data to get some valuable information regarding the mass of the soil fallen and the shape of the cavity formed in the remaining land mass.

II. THE IDEA:

Let us say a Landslide occurred and a part of the landmass has fallen. The fallen mass results in a cavity in the remaining landmass. The idea is to calculate the radius of curvature of the the cavity (also called the slip surface) or just the shape of the cavity. Once we have the radius of curvature of the cavity or the shape of the cavity and the depth of cavity we can calculate the volume of the landmass fallen. Using sample of soil fallen and its density we can easily calculate mass of soil fallen.

Above picture perfectly depicts the surface on which our

Fig. 1. Image depicting a landslide

project can be used. Given model can be put in front of landslide, when turned on this will initially move step by step in x axis after reaching the other end the sensor along with motor will move a step upwards. This will be repeated until entire area of landslide is scanned and entire data is stored in matrix form.

III. APPARATUS USED:

- Arduino Board (Arduino Uno R3 ATmega328PU Price=Rs399)

Fig. 2. ARDUINO UNO

- 2 Big Stepper Motor (Generic Nema 17 800ma 3.5kg-cm 1.8 Step 6 Wire Unipolar Price=2*590)

Fig. 3. Stepper motor

- 2 Small Stepper Motor (12V 300ma 1.8 Step Unipolar 6-Wire Price=2*190)

Fig. 4. Stepper motor

- Motor Driver Board (L293D Price=2*79)
- Ultrasonic Sensor (HC-SR04 Price=2*109)
- Handmade Belt (For rotation along the x axis)
- Handmade Pulley (For rotation along the y axis)
- Aluminum Rod 1.5m (Price=520)

Fig. 5. Motor driver

Fig. 6. Ultrasonic sensor

- Wire
- Battery (9V)
- Bread Board

IV. WHY SELECTED COMPONENTS WERE USED

- Why we used Stepper Motor?
  - Positioning Since steppers move in precise repeatable steps, they excel in applications requiring precise positioning such as 3D printers, CNC, Camera platforms and X,Y Plotters. Some disk drives also use stepper motors to position the read/write head.
  - Speed Control Precise increments of movement also allow for excellent control of rotational speed for process automation and robotics.
  - Low Speed Torque - Normal DC motors don't have very much torque at low speeds. A Stepper motor has maximum torque at low speeds, so they are a good choice for applications requiring low speed with high precision.
- Why we used Ultrasonic Sensor ?
  - We used it because it is available at a very low price.
  - Range of this senor is 5cm to 10m.
  - Accuracy: absolute error 0.035 cm/cm.
  - Precision: standard deviation 0.1-0.5 cm.

V. THE LAB SETUP

Instead of directly building the device for the large scale ,we planned to go step by step. We build the device for the Lab setup of max dimension of 2m X 2m X 1.5m length,breadth and height respectively. The Schematic of the proposed device looks like the following:

A. *Mechanical Model:*

To build the mechanical model of the lab setup we made a mechanical model of dimensions 2 x 2 x 1.5m .The support for this model was provided by two aluminum rods that were broken in two parts using a hand grinder in the mechanical workshop.These two aluminum rods were provided support at the base with a wooden supports that helped in maintaining a constant distance between the rods.

Fig. 7. WIRES

Fig. 8. Battery used

B. *Adjusting the Sensor:*

This model gave up a setup in which we can run our sensors along the x axis for 2 m and y axis for 1.5m. To run the ultrasonic sensor along the x axis we designed a conveyor belt setup. As it was not possible to buy a 4m long conveyor belt as that would have surpassed our budget therefore we made the conveyor belt by rubber belt that is used in doors. We joined two and more such belts by hot glue and stapled it to form a total length of belt that was greater than 4m. Next up we fixed ultrasonic sensor to one of the places on the conveyor belt.

C. *Attaching Stepper Motor To The Model:*

This belt was run along the x axis using two unipolar stepper motors which were fixed at the two ends of the aluminum rod by movable supports. The code for the stepper motors were designed in such a way that the belt with the attached ultrasonic sensors runs along x axis one time and next time the belt moves in the reverse direction so that we can traverse the sensor through the object placed in the front of the lab setup.

D. *Design Of Pulley System:*

To move this conveyor belt setup that were supported on the two stepper motors along the y axis we made a pulley setup at the top of both aluminum rods.
We again fixed two five wire stepper motors for the same, pointing parallel to the ground. These two stepper motors were fixed with nuts and bolts after doing drilling operations. To pick up the conveyor belt setup using these two stepper motors we joined the belt system with pulley made of thread. The code for these two stepper motors was designed in a way such that that after traversing through the x axis and taking the data, the conveyor belt setup is pulled up for a particular distance and then stopped and then again the conveyor belt is traversed to take the data.

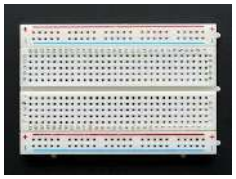

Fig. 9. Bread board

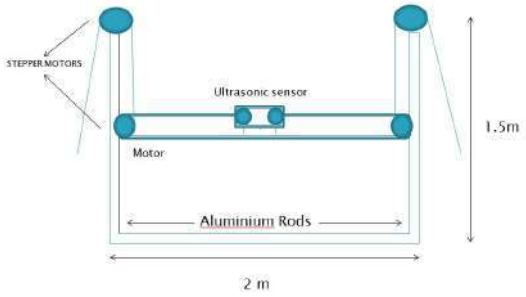

Fig. 10. Image depicting a landslide

E. Final Model

In this way we were able to design the mechanical setup that was capable of traversing along the x and y axis for a distance of 2m and 1.5 respectively,meanwhile taking the data from the sensor which is keeping the track of the distances of the 3D object from the sensor itself.

F. Saving The Data To a File

This data is taken in the arduino and using a software named :"PLX-DAQ" we were able to save the data into a text file and make the matrix.

VI. MACHINING USED

- Aluminum pipe bought has to be cut into two equal halves this was achieved using hand grinding tool available in mechanical lab. Same was used to create grooves in each aluminium strips which later acted as paths for movement along y- axis

- Now we used the snip tool to cut a piece of sheet metal and using the other equipments (like mallet,bench vice) available in sheet metal shop to make the support for motor responsible for movement along x- axis.
- At last we used Wooden jack plane to finish the wooden base and Metal Jack Plane to finish the metal surface .

VII. CHALLENGES FACED

- The first challenge we faced was to control the working of stepper motor. Since a stepper motor is very different from a normal D.C motor, we had to study how to check the center tap and the circuit with same coil. To know the center tap and the wires of the same coils we used multimeter. Once we were able to get the idea of pins of center tap and coils for all motors we made the circuit on the bread board making connections with male-female,male-male, and female-female jumper wires with the arduino wherever required.
- Biggest challenge that we faced was in making of mechanical structure to support our model. Difficulties that we faced during this process were
  - In grinding the aluminum rod in two parts.
  - Building conveyor belt longer than 4m out of rubber belt.
  - Stabilizing the two aluminum rods with the wooden supports at the base so that the rods don't get pulled closer when the conveyor is placed with the motors.
  - The ultrasonic sensor on the conveyor belt
  - Fixing the two stepper motors on top of the rods.
  - To make a pulley system that is powerful enough to elevate the conveyor belt system along with the two motors on which the conveyor belt is attached.
  - To reduce the friction that is encountered when pulling the conveyor along the y axis.
- We also had to connect long wires with the motors and the sensors that remain connected even when our sensors cover the largest distances from the arduino board.

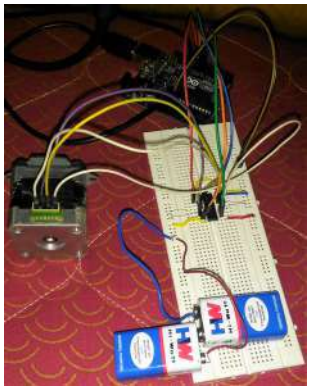

Fig. 11. Image depicting connections of stepper motor to ardurino uno

VIII. INDIGENOUS SLOUTION

- Stepper Motor- We used 6 wired unipolar stepper, we controlled it by giving input signal from arduino uno.
- Conveyor, being unavailable at cheap price rubber strips extracted from doors and windows were used. Sensor was on it using a glue gun and double sided tape.
- Reduction of friction- Aluminum used to make stand with groove in it had a lot of friction. As the conveyor belt was applying for on the motor in front direction friction got increased by a large amount. To reduce amount of friction double sided tape with its cover not removed was used. Its cover being highly smooth decreases friction by a large amount facilitating smooth movement.

IX. FEATURES OF FINAL PRODUCT

Hence our final product was capable of:

- Traversing the ultrasonic sensor 2m along the x axis and 1.5m along the y-axis and taking the distances of the 3D

object or groove present in front of the lab setup with a precision with respect to an ultrasonic sensor.
- Store the data read from the sensor as a text file and prepare a matrix.

X. IMPROVEMENTS PROPOSED

- Not only is the precision of a SONAR sensor very low which effects final result but the time delay of a SONAR is also very high due to which time that sensor has to stop at a place is high, instead if a laser range finder or LIDAR sensor is used not only is the accuracy improved but time delay is also reduced.
- Use of aluminium rod with grooves cut in it increases friction by a large amount due to which power of motor required to elevate the setup is large, instead if lead screws are used power required will be much less as compared to method used.
- Fixing sensor in a drone and then using it to plot a given irregular plane will allow us to scan a larger area without any restriction of size of area to be plotted.

XI. ADAVANTAGES OF OUR MODEL:

Our model with proposed improvements is better than than the current devices used for mapping and surveillance as it does not depends on the angles which reduces the errors due to approximations and results in better resolution of the so generated data cloud.

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The Micro Servo Arm-RECUR

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***Abstract*—Project RECUR aims at automating manual iterative repetitive tasks so as to reduce energy effort and energy consumption put into labour. It is showcased with a prototype and an action remembering arm design which remembers the manual action performed on the protoype and performs it repetetively. It is implemented by using a microcontroller board Arduino Uno, bluetooth module for communication, servo motors for movement, potentiometers to read movement and powered by a Lipo battery. The project has a huge scope in industries and household where a large amount of manual labour can be saved, and put to use in better places.**

***Keywords*—Arduino Uno; Servo Motor; Potentiometers; Lipo Battery; Redundant**

I. Apparatus

- Arduino Uno R-3(x2)
- Bluetooth Module (x2)
- Micro servos 180 degrees (x4)
- 22K-Potetiometer(x4)
- LIPO battery (x1)
- Acrylic board (x1)
- Clipper (x1)
- M-seal

II. Details of components

The components are assembled on an acrylic board in a layout such that they are properly synchronized and the circuit is complete with proper subsections such as mechanical part and circuit part.

1) Micro controller unit:

1. HC-05 Bluetooth Module (Master/Slave):
HC-05 Bluetooth module is a Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with frequency 2.4GHz radio baseband and receiver. It uses CSR Bluecore 04-External single chip Bluetooth system with CMOS technology and with Adaptive Frequency Hopping Feature(AFH) [4]. The two bluetooth modules in this project are connected in MasterSlave configuration. The master can send or request data from the slaves while the slave can only receive and transmit the data between each other. Slave can only be connected to a single Master and slaves cannot connect to each other.The master can connect to many slaves [7].

Fig. 1. HC-05 Bluetooth Module with frequency 2.4GHz. [9]

2.Arduino Uno:
Arduino is a microcontroller board which is based on the ATmega 328P. It has 14 digital having input/output pins(6 PWM outputs), 6 Analog inputs ,an ISCP header, a USB connection , a power jack and reset button. It works on basic programming principles which includes a well compiled written code which has to be uploaded on a board using a software specifically created for Arduino coding. [8]Two arduinos are used in this project, one for the prototype and other for the working model.

Fig. 2. Arduino Uno R3 Board. [8]

2) Mechanical Components
1. Servo Motor
A servo motor is rotary actuator or linear actuator that allows for precise control of angular or linear position, velocity and acceleration [3]. It consists of a motor with

Fig. 3. Micro Servo Motor 9g SG90 [5]

a sensor which gives the feedback on the position of the motor.It works on the feedback mechanism. It requires a controller like arduino, with a module designed for use with servo motors. The receiver Arduino decides the amount of rotation to be performed by the servo motor. The angle movement of the servo motor is set through a duty cycle of the signal given to the servo motor. At a duty cycle of 50% the shaft of the motor is at 90 degree, and at a duty cycle above it, it moves towards 180 degree and below it towards 0 degree. Four servo motors are used in this project in the working model.

2. Potentiometer

Fig. 4. Potentiometer with three terminals. [6]

A potentiometer is a three-terminal resistor with a sliding or rotating contact that can be used as rheostat or voltage divider [2]. The outer pins are for +ve supply and Ground while the middle pin is for analog signal that is passed to the 10-bit ADC(analog to digital converter) which is responsible for converting the analog output to digital input which is sent to other arduino using bluetooth module.

III. Motivation of the Project

Seeing many workers on the construction site do the same intensive repetitive task again and again, consuming lot of energy and tiring them, inspired us to make something to reduce their effort. Also seeing our mothers do repetitive action in many tasks at home added to our interest to make something which reduces redundancy of human tasks. Hence, we made this human arm which can record arm movements and remember them and can perform repetitively.

IV. Algorithm

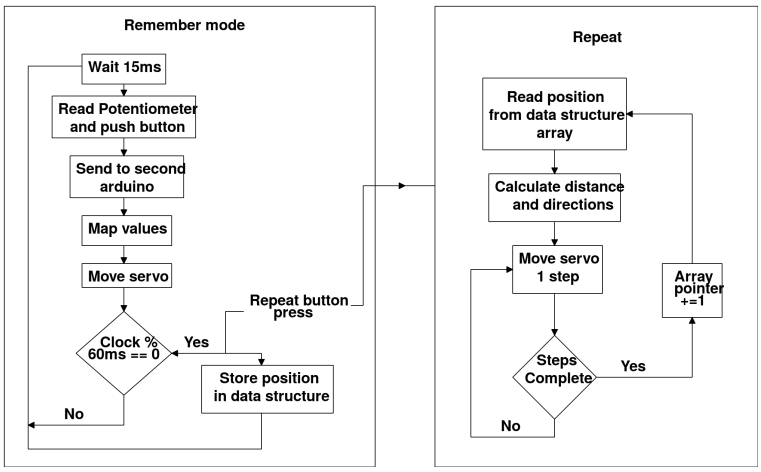

Fig. 5. Flowchart depicting algorithm of the robot.

V. Analysis and Working

Analysis of the construction and working of the robot in lucid words .

1) Construction
   Our model consists of a prototype and a working model. The prototype is a replica of human hand consisting of three pieces of acrylic board arranged in such a manner that they represent the shoulder, elbow, wrist and fingers which was controlled by a push button and the memory button for toggling to the memory mode. On the working model we have an identical structure but consisting of servo motors in place of potentiometers.
2) Working.
   Any task performed on the prototype will be repeated by the working model in the same pattern. At the same time it will memorize the complete task and hence it can perform any task performed by human hand. These memorized actions can be overwritten and a new set of action can be made to remember. Different types of actions can therefore be performed as and when required by the user.

Details -

When any task is performed on the prototype by moving the prototype joints, the potentiometers (acting as voltage dividers) on rotation generates analog output through the middle pin. All the 3 pins of the potentiometers - the input, output, the signal output are connected to analog pins(A_0, A_1, A_2) on the arduino board. The analog output generated then goes to the 10-bit ADC (Analog to Digital Converter) on the arduino (micro controller) which samples the analog signal into 1024 values. These digital value range of 0-1023 values are mapped to the servo motor's movement range.

The arduino divides the movement range of the servo motor from range of 0-179 into range of 1000-2000. The potentiometer can rotate approximately 270 degrees, which is higher than the rotation range of the servo motors. Hence only values pertaining to range of 0-179 degrees from the potentiometer

are taken and mapped.
The potentiometers are calibrated for the three corresponding servo motors as follows -
1) 400-1023 for wrist potentiometer,
2) 300-1023 for elbow potentiometer ,
3) 400 - 1023 shoulder joint potentiometer.
For the fingers, a pair of clippers are used, which are controlled by a switch from the prototype. The push button is grounded on the arduino and has LOW state when switched off. As soon as it is switched on it is pulled up to a HIGH state. The LOW and HIGH state of the switch is read according to which the clippers are opened and closed.

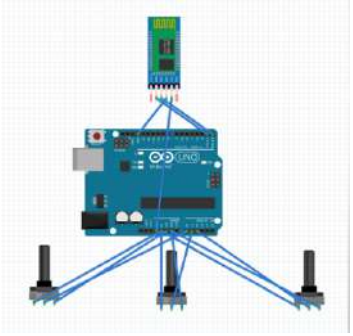

Fig. 6. Circuit of the prototype representation.

These values of potentiometer and clipper state are read into one arduino. Then with the bluetooth module, these are transferred to the working model arduino. The second arduino then maps these values to the servo motor range. These are then passed to the servo motors with the writeMicroseconds() function according to its previous position due to which it is able to replicate the motion as performed on the prototype. The writeMicroseconds() is an arduino function which takes one value as parameter and converts it to a duty cycle and moves the servo motor accordingly.
A clock timing is also maintained during task, according to which the position of the servo motors are taken with readMicroseconds() function and stored into memory in a data structure after every 60ms for a total span of 30seconds.
A push button is used to switch state from remembering to performing state. In the performing state, the sampled values of action stored in a data structure are retrieved and traversed. As the speed of the servo motor depends on the current angle and the next angle, the value passed to the servo is given in stages. The direction of the next state from the current position of the servo motor is determined. Then a sweep function is made to the next state by moving the servo motor step by step with a 15ms delay.
The bluetooth modules are configured in the master-slave configuration. The prototype bluetooth module behaving as the master and working model module behaving as the slave.
The reset button on the arduino, removes the current remembered action, so that a new action can be performed and remembered. The reset button is internally connected to active LOW which pulls down the micro controller state and all the data of the sequential circuit are lost.

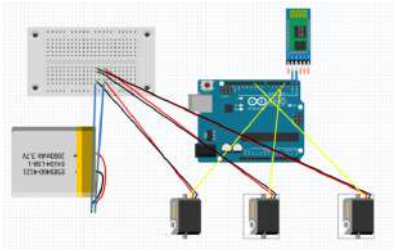

Fig. 7. Circuit of the working arm representation.

VI. Protoype and Working Arm

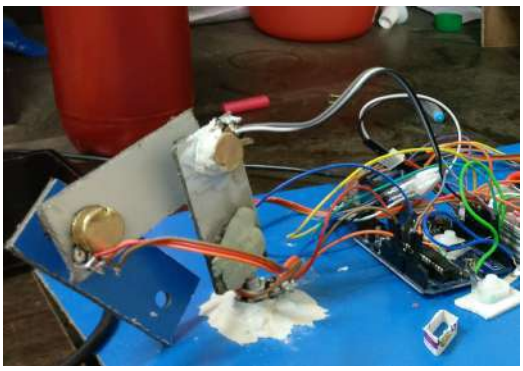

Fig. 8. Protype and its connection on arduino.

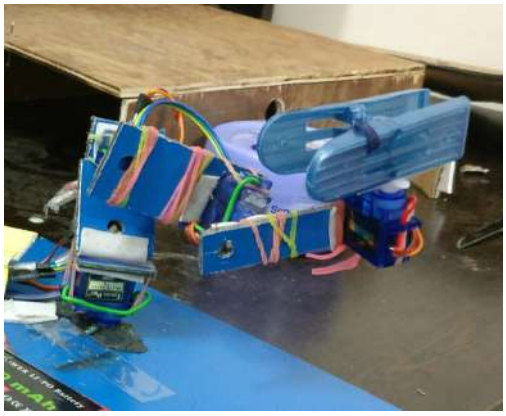

Fig. 9. Working arm with clipper.

VII. Applications

1) At construction sites, to do repetitive work of labourers. In moving sand and construction material, hammering, placing things etc.

2) In industries like bottling plants and automobile industries, where same action is performed again and again. Like bottling of caps, attachment of wheels can be done with accuracy and perfection and then rememorised a different action on the same robot.

In an industry like automobile, this would be highly beneficial to perform different repetitive tasks and save expenses.

3) In villages, where the people need to perform very physically intensive tasks repeatedly. Recur can be used to perform those tasks and reduce human efforts, like picking up water from well, using handpump for water, removing weeds from agricultural fields, digging etc.

4) In urban homes, can be used for performing same repetitive tasks and actions like brooming action, chopping of vegetables, wiping and moping etc.

VIII. Advantages and Limitations

1) It reduces human effort and minimizes the decline in quality of work due to human tiredness.
2) Maintains uniformity of work and increases efficiency and accuracy of the action.
3) Since it is not hardcoded it can be used to perform many different kinds of tasks one after another.
4) Since Arduino UNO uses Flash memory of 32Kb(of which .5k is used for the bootloader), SRAM of 2Kb only hence very less amount of memory is available for remembering.
5) The power of the servo motors used is not very high to do very intensive tasks.

IX. Scope

1) We can use sensors to receive data about the surroundings and improve the working of our model in different areas by making it adapt to the surroundings. These data can also be modelled and trained by using machine learning techniques to make predictions and subtle changes in action to adjust to the changing environment and finishing tasks.
2) Different kinds of clippers can be used for efficient and multipurpose uses.
3) Sensors to detect task completions and environment changes can have better control over the model and avoid any excess use of memory and energy.
4) We can use Arduino Mega(with 256K of program memory and 64K of SRAM memory) for more flash memory or we can also use a micro SD module for remembering multiple actions which we can select from.
5) Addition of wheels to the working model, so that area of its working can be greatly increased.

X. Conclusion

This project is an innovative arm to reduce redundant human effort and tasks. The redundant and repetitive tasks performed by human arm are automized. It has replication of the human arm joints and fingers and has its movements in all 3 axes for proper implementation as an arm. It has good application of concepts of applied electronics and details about arduino and communication signals and algorithms. It has been able to do different tasks at different times, by changing the task in memory through prototype. The project has a lot of scope can make an impact on the society.

XI. Acknowledgement

In the process of making our project, a number of people helped on the way. Firstly, a heartful thanks to Prof. Hitesh Shrimali and our mentor Prof. Ankush Bag for his motivation throughout the project. They supported us morally and gave knowledge about different technical equipments and concepts that we have used. Next, thanks to our so pro-founded seniors Gopal Krishan Aggarwal, Kushagra Singhal and Indresh Kumar Gupta who were always available to help us in all sort of things.

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PROJECT DAREDEVIL
Empowering The Blind

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***Abstract*—The project titled "DAREDEVIL" was envisioned from the namesake of Marvel universe , and is the touchstone for the kind of life , upto which , the visually impaired may be empowered ,by this project .**

The project is a demonstration of , how , simple things can combine together to punch a significant contribution to the society. We have integrated a simple walking cane , and a pair of gloves with some electronics , circuits , programming and design to come up with a smart stick and glove , which can contribute a long way , in the upliftment of the visually impaired community . Moreover , the power requirements , maintenance , and overheads are minimal , and the social impact , huge !

I. Motivation Of The Project

The visually impaired , account for around 285 million of the world's population , the statistics being presented from a report of the World Health Organization , and that is the strata ,that "THE DAREDEVIL" empowers.

According to some statistics from the World Health Organization :

- Out of the total population of the visually impaired ,only one-tenth of the population resides in the developed world . The rest belong to the developing , or the third world countries .
- Around 65% of the visually impaired population are senile , vis-a-vis , aged above 50 years .
- The net contribution of this age-group to the world is around one-fifth of the net population .
- Moreover , around nineteen million children in the world are ophthalmologically retarded .
- Out of these, about twelve million children are disabled in some or the other respect , of their opthalmological physiology . About one and a half million are irrevocably blind .

The impact of these opthalmological debilitations and limitations ,is not only physiological , but also ,later amounts to social , psychological and emotional defects in the lives of these people . PROJECT DAREDEVIL aims to amend , or at least , ameliorate some of these problems .

This scale of the impact of our project and the scope of improvements enthused us , and motivated us to pursue it to its completion .

II. Introduction

The project , currently costing around Rs 2000 , and whose cost may be further lowered to within Rs 1500 , comprises a smart cane and a complimentary pair of gloves for the blind .

Figure 1. Smart Cane

- The cane , using the same SONAR technology that is used in aircraft and naval navigation , can detect objects in the range of about 4 m , covering a solid angle of 15 steradians , in front of the person , and providing an intuitive commuting experience . It does that via haptic feedback , using vibrating motors to alert the user of any possible obstacles in front of him , and the distance

still left , using the intensity of the vibration , to do so.

- Another feature of the cane is its GSM/GPPRS-enabled communication , which can currently communicate via SMS , with any number , that is hard-coded into the cane , by pushing a button mounted on the switch.
  This is intended for any hazardous or emergency situations . Moreover, this feature can be further developed , so as to provide the location of the person , and communicate with multiple people , via SMS or call ,if need be .

Figure 2. Smart Glove

- The glove integrates with the cane , and has an in-built device-tracker mounted on it, so that, in case, of loosing the cane, the person, by pushing a button can detect the device, by the sound that it emits. This has been possible, using radio-waves' emission and detection circuits mounted onto the system, using radio waves of 433 MHz, which currently provides an operating range of about 50m radius, and may be further enhanced to about 200-300 m in further stages, along with device-specific encryption.

- Another specialty of the glove is its temperature sensor . Mounted on the fingertips of the glove , it can provide the ambient temperature , any time of the day . When coupled on the glove, it provides haptic feedback to the user , if any hazardous temperature range is encountered in by the object . However ,the catch is, that it does that from a distance , that is , you do not need to touch a hot object to sense its temperature , only bring your glove near it .

This project is , however ,only a proto-type , and could be further improved , and extended to interface with a variety of devices to empower the blind ,to an unparalleled scale.

III. Components Used

COMPONENTS REQUIRED :

Product Information	Product Price	Quantity	Subtotal
6x6 mm 2-Pin Tactile Button Switch	Rs. 2	1	Rs. 2
Arduino Uno R3 ATmega328PU with USB Cable	Rs. 399	1	Rs. 399
Battery 9V	Rs. 20	2	Rs. 40
HC-SR04 Ultrasonic Distance Measuring Sensor	Rs. 109	1	Rs. 109
LM35 Temperature Sensor	Rs. 50	1	Rs. 50
RF 433 MHz Transmitter & Receiver Set	Rs. 150	1	Rs. 150
SIM900A GSM / GPRS Modem (TTL with Serial interface)	Rs. 950	1	Rs. 950
30 mm Wire Type 3-24V Piezo Electric Buzzer	Rs. 25	1	Rs. 25
9V to 12V DC Vibration Motor	Rs. 20	1	Rs. 20
Arduino Battery Power Cable	Rs. 40	1	Rs. 40
Vells 22mm NO NC Green Push Button	Rs. 40	1	Rs. 40
Arduino Pro Mini ATMega328P	Rs. 190	1	Rs. 190
TOTAL			Rs. 2015

Figure 3. Price Distribution Table

NOTE :- Pair of gloves / sports band + Walking cane have been considered complementary , since our project is supposed to be mounted on any set of hand gloves and walking cane.

IV. Products' Description

A. Specifications for the HCSR04 Ultrasonic Range Finder

- Power Supply needed - 5V
- Angle of detection of objects- $< 15°$ in every direction.
- Resolution of the sensors - 0.3 cm
- Range of the sensors - 2 cm – 400 cm

B. Specifications for LM-35 Temperature Sensor

Features:

- The DC power supply needed is 2.7 V to 5.5 V
- Scale factor(used to convert output voltage to temperature) of the equipment is 10 mV/°C
- There is a error of ± 2°C in temperature detection
- The sensor must be operated between -40°C to +125°C

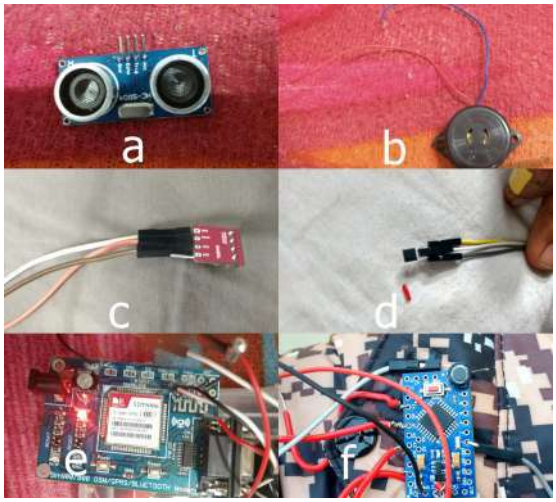

Figure 4. (a) Ultrasonic Sensor (b) Piezo Electric Buzzer (c) RF Transmitter (d) Temperature Sensor (e) GSM Module f. Arduino pro Mini

C. Specifications for the RF Module

1) Receiver Module Specifications:

- Operating Voltage(DC)- 5V.
- Current(Static)- 4 mA.
- Receiver's frequency- 434 MHz
- Dimensions- 30×14×7 mm.
- Sensitivity- 105 DB.

2) Transmitter Module Specifications:

- Operating voltage(DC)- 5-12V .
- Operation frequency- 434 MHz.
- Current (Standby)- 10 mA.
- Operation current- 20-28 mA.
- Transmission distance limit: $>$ 10 m.
- Output Power- 16 dBm.
- Rate of data transfer- $<$ 10 Kbps.
- Mode of modulation- ASK (Amplitude shift keying)
- Operation Temperature- -10° $\sim$ +70°.
- Dimensions- 19 $\times$ 19 $\times$ 8 mm.

D. Specifications of Arduino UNO R3

Here are some operating specifications :

- Micro Controller- ATmega3288
- Voltage input- 7-12V
- Total 14 digital I/O pins including 6 PWM output pins.
- Input (Analog)- 6
- Flash Memory- 32k
- Clock Speed- 16 MHz

E. Specifications of Arduino Pro Mini

The version of Arduino Pro Mini used in our project runs on 5V and 16 MHz. Here are some operating specifications :

- Micro controller- ATmega328
- Operation Voltage- 5 V
- SRAM- 2 KB
- I/O pins (Digital)- 14
- Input pins(Analog)- 8
- Flash Memor- Total 32 KB in which 0.5 KB is consumed by boot loader
- Clock Speed- 16 MHz
- EEPRO- 1 KB

Note : The Arduino Pro Mini generally requires a USB-TTL board to interface between the Arduino IDE and the PC . However , we simply used one of the spare Arduino UNO R3 boards (after removing their micro controllers) to burn the programs directly into the Pro Mini. Hence , the USB-TTL board has not been listed as one of the product components.

F. Specifications of Piezo electric buzzer

To provide audible feedback to the user we used piezo electric buzzzer. The special property of piezo electric materials is that they can generate electricity when mechanical stress is applied to them and vice-versa.

G. Power source

- The power source that we are using in this project is 9 V household , alkaline , PP3 batteries. Our completed product utilizes three 9 V batteries , which are easily replaceable , and accessible household item , anywhere .

- The power input to the Arduino UNO R3 and Arduino Pro Mini are two 9 V batteries , while the third one is being used up by the GSM module. However , we have now figured out a method to reduce the number of batteries to 2 , simply by using the same 9 V battery to power up the Arduino UNO R3 , and the SIM900A GSM Module. Hence , we have now reduced the operating number of batteries at any single time to two 9 V batteries , at maximum.

Note :- Devices that use these batteries are generally designed to work until the voltage drops to an end point of typically 5.4 V. Same would be the case with our device ,except the case ,that our device is also capable of functioning optimally , at around 5 V . Hence , despite some reduced functionality , like haptic feedback , we have managed to extend our device performance optimally .

V. Principles

A. Range Finding using ultrasonic device :

Ultrasonic sensors emit high frequency signals at certain intervals of time . In ultrasonic sensor basically we have two sensors, one for sending the ultrasonic waves and other to receive the reflected waves getting reflected after colliding with obstacles in their path . The distance is calculated by the time lag between transmitting and receiving of signal.

B. Device tracking using transmission and reception of radio waves :

RF modules are used for transmitting and receiving data(data is transmitted as radio waves) thus establishing a connection between the glove and cane . This consist of a transmitter placed on glove and a receiver placed on cane . The glove (through RF Module) serves as device tracker for the cane.

C. Panic button for emergency :

For networking (sending the message to the family/police in case of emergency) we are using GSM SIM900A . Mobile numbers are hardcoded into the code . As soon as the GSM module gets the digital input 1 (Push button - On) the required message is sent to all the contacts present.

D. Staying away from drastic temperatures :

Temperature sensor used is LM-35 which comprises of two dissimilar metal plates which produce electrical signals. It is typically a thermocouple or a resistance temperature detector. It generates electrical voltage with direct proportion to the ambient temperature. Thus warning the user of any object having temperature above or below the safe range.

Here is the link to the testing phase of our project : Project Daredevil

VI. Result and Discussion

We succeeded in making the product the same way as we planned. With further improvements , we can actually turn this whole concept into a suite of products , that interface together , and provide a touchstone ,for the kind of life that a visually impaired person may lead .

This product , and the time and resources that we spent making it , enhanced our confidence on our ability as engineers , as creators and designers , and the practical work , actually invigorated us ,with the engineers that we dreamt of growing up to be ,partially realizing in our eyes .

The social impact of our product , also opened us to a possibility ; of creating simple products from simple components , yet having great scope and scale of implementation .

To epitomize our project and product , we quote Steve Jobs ,who once said :

”Simplicity is the ultimate sophistication”

VII. Conclusion

Working on this project has been a wonderful experience .This project familiarized us with different electronic components , extended and stretched our creativity and productivity , and taught us to look, search for problems , and further, pursue and solve them .Being an interdisciplinary project , having some pre-requisites , such as basic knowledge and involving various aspects of mechanical engineering, computer science and significant electronics , it required the team work , and coordination ,to be a significant , useful product . It was great to be a part of creating something towards the welfare of the society .

Other than the technical aspects we learnt team spirit, time management, resource management and sharpened our presentation skills. Also it improved our practical understanding of the subject. We efficiently combined our strengths and finally made a cost efficient product which could be used for the amelioration of the society and improve the life of the visually impaired.

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Other people , who helped , and directly or indirectly ,contributed to our project

- **Indresh Kumar**
- **Pulkit Rajgadiya**
- **Abhishek Sharma**

and others too !

More importantly , we all wanted to thank IIT Mandi, for giving us this excellent platform ,which coerced us to extend ourselves , and then forged confidence in ourselves ,as engineers, to design ,innovate , create and build great products .

AAVISHKAR PROJECT 2017
THE VOICE WHEEL

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***Abstract*— Through out the evolution of mankind we have been striving hard to reduce human effort and also to facilitate those who are deprived of physical gifts by God. So in this project of ours we have tried to solve both the problems. Our bot VOICE WHEEL is a revolutionary vehicle that suffices both our need and greed. For the paralysed people who can't speak we have used mobile's gyroscope to control the bot. Just by moving the mobile up,down and side ways we are able to move our bot in forward, backward, right and left direction. Also for people who can speak but can't move their body parts we have used voice module to control the bot. As we had stated earlier , our bot is not just for need but also for greed. If your a lazy one, then just by your voice and hand gestures you are able to control the bot. The voice module uses the Google API for voice parsing. And the most fascinating thing is that our bot is just a prototype. By simply improvising the bot we can solve various trivial problems and simultaneously reduce human effort.**

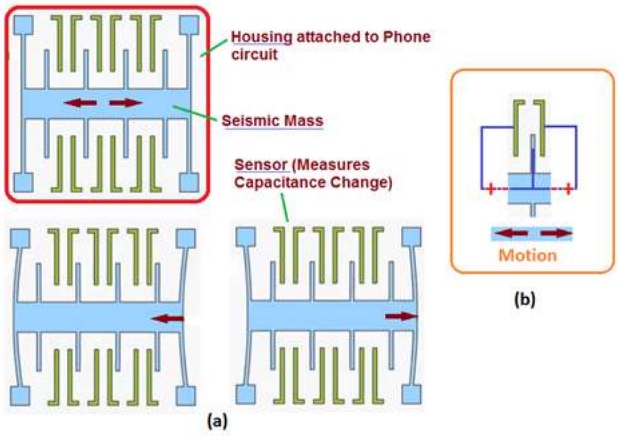
I. Components Used

1. **Arduino (UNO):** It is a microcontoller that controls the bot. It receives signals through the bluetooth module and then works according to the the code that is written in Arduino. For instance if through the bluetooth module it gets the command of move forward then the function of arduino code that has forward commands gets executed. The same happens for other commands.
2. **Bluetooth module (HC-05):** We have our arduino connected to the the mobile through a bluetooth module. It facilitates the transfer of instructions from the mobile to the arduino.
3. **Motor Driver (L293D):** It takes in the input from the arduino and controls the motors of the wheels and makes it move in nforward and reverse direction.
4. **Robotic Kit:** It contains the chasis, the motors and the wheels.
5. **Breadboard:** To make connections.
6. **Battery:** For driving arduino and motors.
7. **Wires:** Connecting and jumper wires.

II. HOW DID WE DO IT ?

The Direction Control app and the Voice Module app have same modus operandi. These apps send in the commands to the arduino through the bluetooth module as Strings and then the Arduino works according to the code.
Our bot works through mode of signal input: Direction Control and Voice Command.

1. Direction Control: This mode of communication is according to the direction of phone. It is based on the accelerometer chip. It is possible because of MEMS (Micro Electro-Mechanical Systems) which consists of a micro chip consists of a specially designed capacitor like shown in diagram.

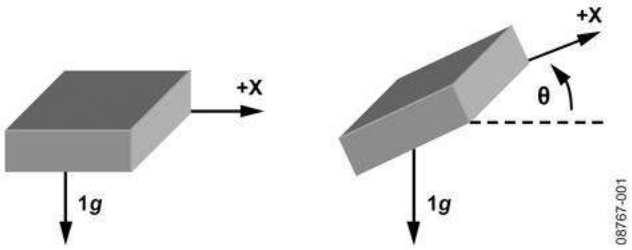


The figure (b), a cutout of figure (a), shows change in capacitance as a result of change in position of Seismic mass, when smart device is tilted or changed in orientation

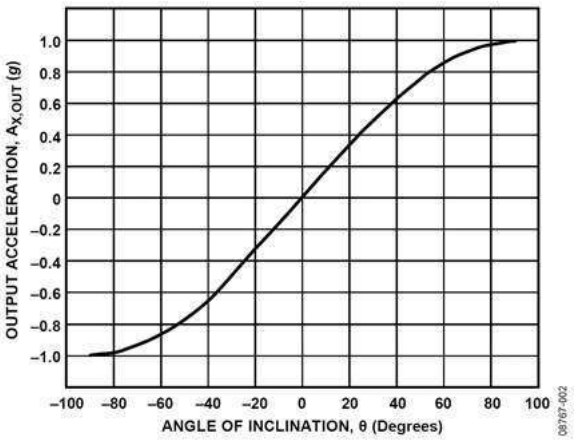
It has a gravity sensitive weight which responds to change in acceleration due to gravity according to change of angle of the phone. This response of the weight causes the relative distance between the plates or the relative surface area in contact for the plates to change and this change results in signal generation which is finally converted to commands with a series of processes with the respective components.

Algorithm:

$$A_{X,OUT}[g] = 1\ g * \sin(\theta) \quad (1)$$



Single axis used for tilt sensing



Output acceleration versus angle of inclination for single-axis inclination sensing

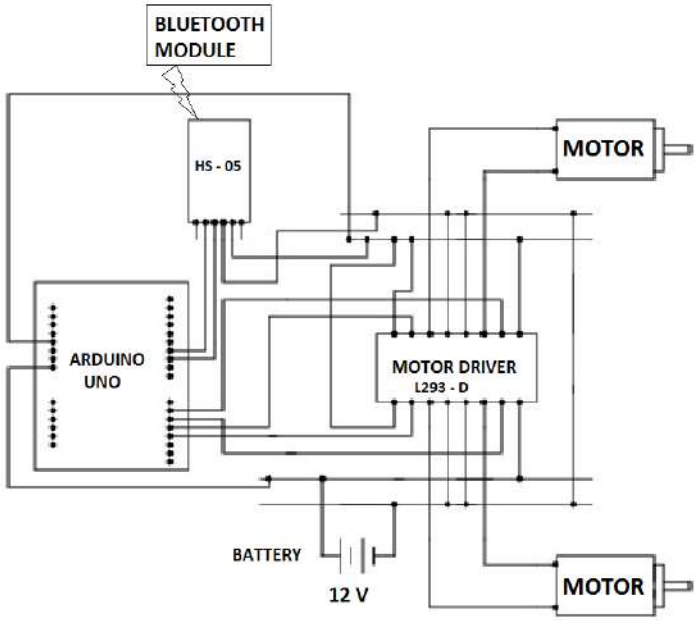
stop

Screenshot of app used

2. Voice Command: Voice command is taken through a microphone, processed in arduino and sent to the robot and finally the robot acts accordingly. This uses Google API. As a command is spoken, it search for it over Internet and parse the meaning of each word and enters the section of code dedicated to that word. You cannot speak any work. a certain specific words are allowed only.

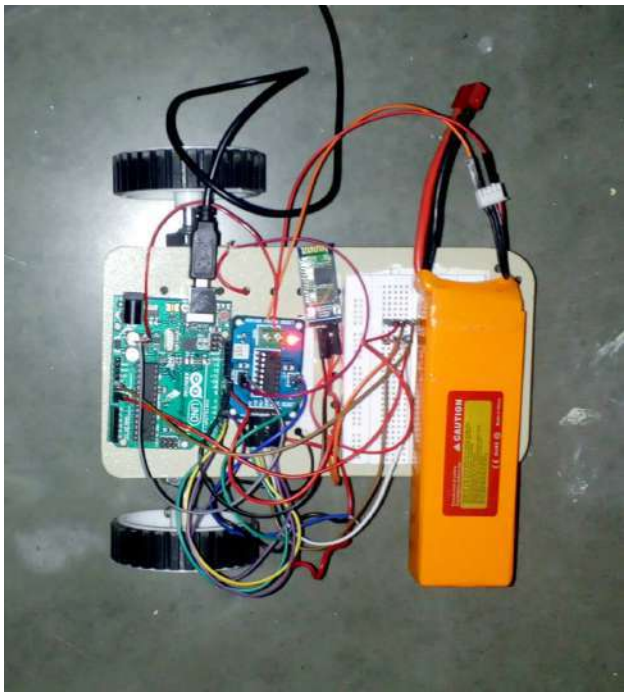
Screenshot of app used

III. Circuit Diagram



Circuit Diagram of model

IV. Working Model



V. Social Impact

Can be used by:

- Farmers during harvesting.
- Can be used at Railway stations to carry luggage.
- For the nurses to carry medicines and machines in hospitals.
- For the waiters in hotels and restaurants to carry food order and room service equipments.
- For helping to carry light loads while shifting the house to some nearby area.
- For mopping the floors in our house and also carry loads of clothes after washing for drying.
- Can be used as lawnmower.
- Delivers product to different warehouses.
- Carry babies when you have to carry some load also.
- For spying purposes (if we are able to reduce size of robot).

VI. Limitations

Well nothing is perfect and all have imperfections in them. Nothing is different with our bot. Despite being futuristic and having specifications that could change how we look at automobiles, we also lack in certain fronts.

First and the foremost thing that we acknowledge is that voice processing is pretty slow and not upto the mark. This is because of the fact that we use Google API and it has to scan all words in the internet to process.

Second is that we are unable to control the speed of the bot by using gyroscope. We used the limiting values and that was the reason that the transition seemed a bit abrupt.

Also to operate it on a bigger scale we need to improvise a lot.

VII. Conclusion

In this project of ours, we have tried to create a bot that follows human voice and the movement of human hand(by using gyroscope). This bot as stated earlier can be used in various arenas of life to reduce human efforts and also to help the ones who are physically deprived by God.

However improvements can be done such as the voice processing speed can be increased by using Speech Recognition Grammar Specification(SRGS) and also we can control the speed of bot by aliteration in the code of direction control app. Even with these imperfections, the bot works perfectly fine without any glitchers.

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2

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Avishkar Project
Autonomous floor cleaner

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***Abstract*—To come with a project.Going by the defintion of a engineer,he/she is the one who gives solutions for the problems available around or in the society.It might take several kinds of engineers to solve a larger problem.Since we are starting our career as an engineer,we took an problem which is an everyday problem and in a smaller scale.So,we took the task of finding a soltuion to the House-cleaning task.We eventually came up with an autonomous floor cleaner that cleans the room by just the 'on' of the button.This robot can do multitasking such as moving around in a well planned manner,vaccum cleaning and mopping.This robot will have a great impact in the everyday life of a busy individual.**

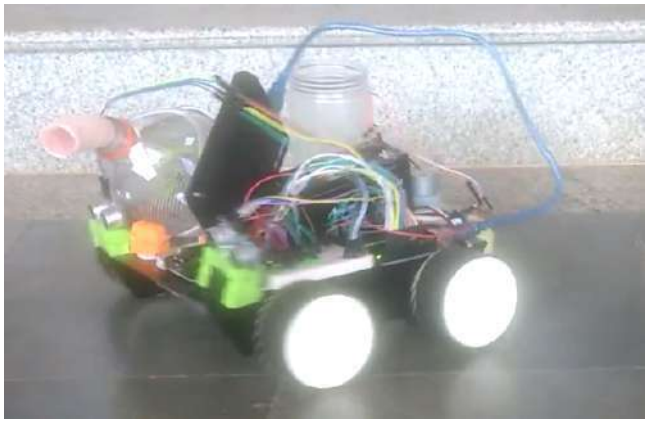

Fig. 1. Autonomous floor cleaner

I. Components used

A. For the mobility of robot

1) SS Black Jumbo Robot Chassis
2) Robot Wheel 7x4 cm Tractor Shape
3) 300 rpm 12v dc metal gear motor torque 2 kg-cm
4) Arduino Mega 2560
5) 12v rechargable lead acid battery
6) Ultrasonic senor module
7) Breadboard
8) Motor driver module
9) Jumper wires
10) 9 volt battery

B. Vaccum cleaner

1) 2000 rpm Brushless motor
2) ESC
3) Arduino mega
4) Recyclable fanta bottle
5) 12V battery
6) Criss cross net.
7) Small sizepropeller.

C. Mopping

1) 500rpm DC motor
2) 12V Battery
3) Container.
4) Straw pipes
5) Scrubber.

Fig. 2. Some of the components used are: 1.Chasis 2.Arduino mega 3.2000 rpm Brushless motor 4.Ultrasonic senor module 5.ESC 6.Propeller 7. 12V battery 8. 300 rpm 12v dc metal gear motor torque 2 kg-cm 9.Motor driver module

II. Introduction and Motivation for the Project

An autonomous floor cleaner is a bot that cleans a confined space without application of any manual labor. The floor cleaner moves around and cleans the space by just pushing it in on stage . The robot senses the obstacles that hinders its path,and avoids or moves around it to complete the path.It works efficiently in a well constructed place such as a room.The robot works hand in hand with the vaccum module and the mooping module to achieve its general purpose.
The project was created with a sole aim to make the clenaing task easier and therefore saving time and labour. Our main motivation for the project came from the acknowledgment of the fact that with life getting busier, many of the urban families find it difficult to keep the house clean.

III. DESIGN

The autonomous floor cleaner is basically a machine that cleans a particular that is under its scope.The robot basically constitutes of three modules:

1) Base
2) Vaccum cleaner
3) Mopping

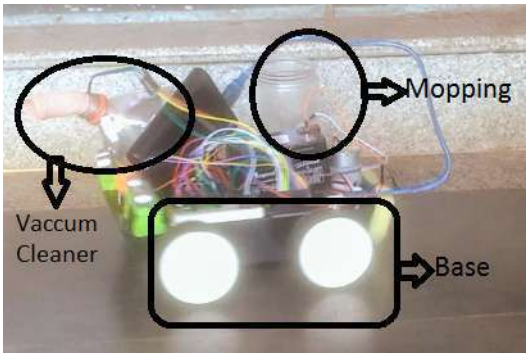

Fig. 3. Different modules of the bot

A. Base

It is this part of the robot that takes care of the mobilty function.

1) Mechanical structure: The base mainly consists a chasis to which the wheels alongside the gear motors are attached.The rest of the component lies on the chasis.Ultraonic senors of two units are attached on the forefront of the chasis.

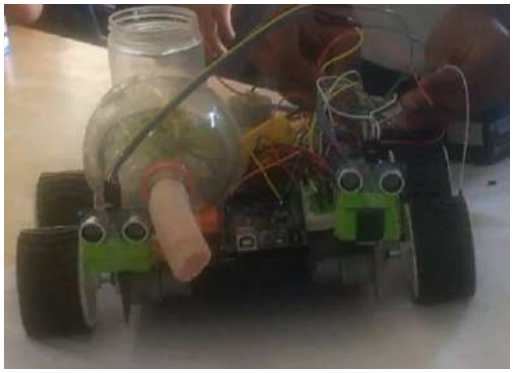

Fig. 4. Ultrasonic senors attached in the front

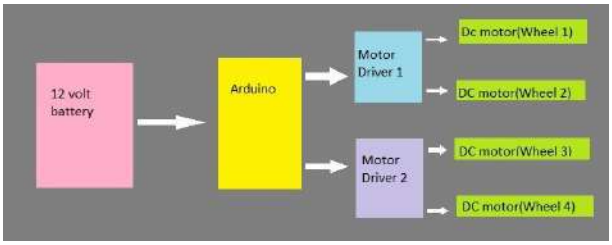

Fig. 5. The circuital model of the moving part of the robot

2) Electrical design and the working principle: The above given is the model of the circuit diagram used. The arduino connects the motor drivers.The 12 volt power supply powers both the arduino and the motor driver.

The arduino controls the motor driver which in turn controls the dc motors that are attached to the wheels.So,the direction for the robot is given by the arduino.The ultrasonic senors plays a very central role in this part of the bot. The sensors

have a transmitting and recieving transducers mounted on the senor.A pulsating wave is send and the reflected wave is recieved by the sensor. The time elapsed for the interval is measured and it is used to calculate the distance. A minimum distance is set(25cm) and when the distance calculated through the senor is lesser than this set minimum distance,it implies the presence of a obstacle. So,the floor cleaner moves away from the obstacle and continues its further practice.

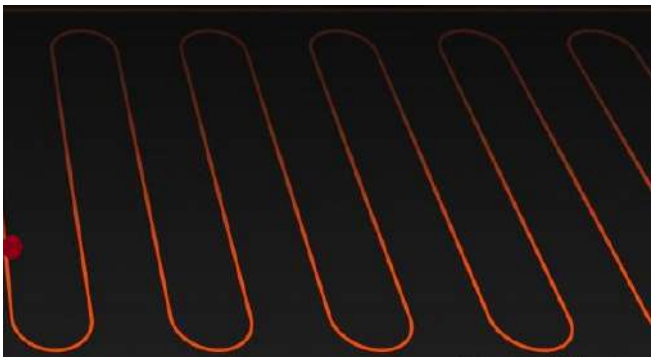

Fig. 6. Practical representatiomn of the algorithm

The algorithm that we used for the robot is a very efficient one.For example,if the robot is left at one corner of the room,say there is a wall present at left and back with respect to the robot.Then when it first detects a robot, it takes a right turn(of 180 angle) and in the presence of next obstacle it takes a left turn. So,in this way the robot covers the entire space.

B. Vaccum cleaner

The vacuum cleaning machine in our robot is made of the simple recyclable plastic bottle where the working component is consists of a brushless motor in order to attain high velocity in association with an ESC(electronic speed controller).The brushless motor converts the dc power supply to AC power supply and the ESC controls the speed of the motor as we cannot use a motor driver for it.The dust is collected in the front portion of the net where it sucks the dust particles and stores.The front portion is openable for removing dust particles time to time making it handy for use.The ESC is connected to the Arduino whereby the command for its operation is driven.The rest ends are connected to a 12V battery power supply.

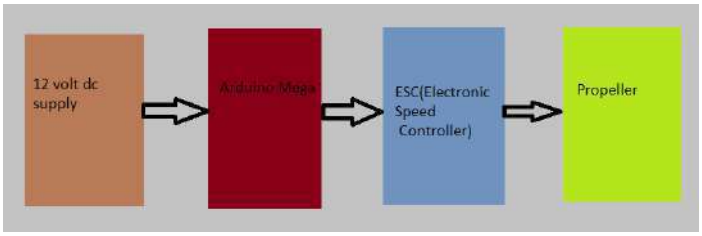

Fig. 7. Electrical Representation of vaccum cleaner

C. Mopping

The mopping portion of the robot is installed at the back of the chassis .It consists of a water tank, and a motor attached to a sponge scrubber.While the robot is turned 'on' the scrubber rotates along with the motor simultaneously the water is mixed with a cleaning disinfectant liquid like Dettol or Lysol and poured into the water tank. As the robot advances the mopping is done side by side.The drip rate of the mopping portion is taken care by the number and size of holes in the pipe to which the water tank is connected to, thereby cleaning the floor which has been free from dust cleaned by the vacuum cleaner in front.

IV. Results and Discussion

The autonomous floor cleaner works efficienty in all aspects.The robot works with greater precision and accuracy in a well constructed space without many small sized obstacles.As for the obstacle avoiding part,sinc we would accomodate only two ultraonic senors due to the lesser number of pins available in arduino uno.To detect small obstacles,more number of sensors can be accomodated by using a different arduino.

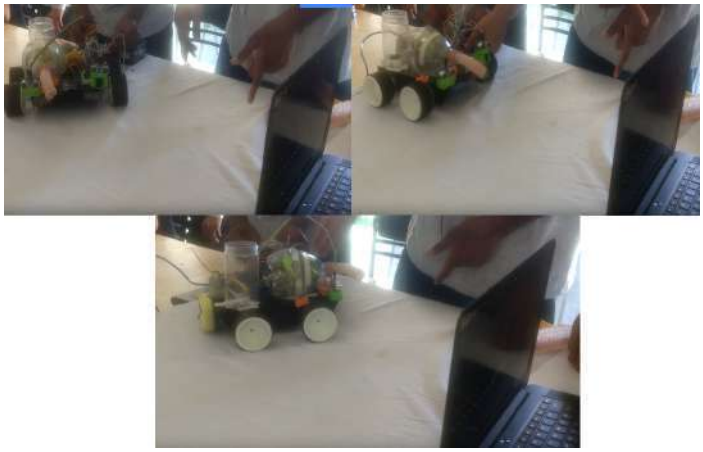

Fig. 8. The robot avoiding the obstacle

The vaccum part,made from scratch works the way it has to.It sucks in objects that are smaller than its vaccum nozzle present in its path.Different kinds of ready made nozzle can also be installed to the vaccum pipe for different purposes.

Fig. 9. Different types of nozzles

Fig. 10. Pictures showing the working of vaccum cleaner and the final picture showing the dust particle getting collected inside the vaccum chamber

The mopping part is the final part attached to back portion of the chassis.It is a simple structure which can be used to do dry as well as wet mopping according to the need.

Fig. 11. Mopping part

V. Conclusion

It is fully automated cleaner and it also serves mopping in addition to the vaccum cleaning.The technology has always grown in a path to make any task easier.This project is one such venture.
This robot can be further developed to meet much more tasks. It can be used to clean a open space such as a road or a ground. It can also be developed with some more additional components and a code to give this robot a much wider scope. This robot can do the cleaning task better than a human.So it is a neccesary electronic gadget that must go into the household.Many useful features can be added to make this much greater. Some of the development that can be done are:

1) Controlling the robot through a smartphone.
2) Emitting light during night cleaning.
3) Detecting wet regions in its path and cleaning accordingly

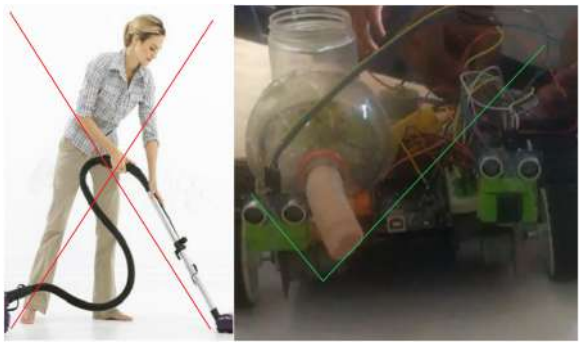

Fig. 12. The present and the future

VI. Refernces

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Landslide Monitoring Device

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***Abstract*—The land of Himachal pradesh is prone to Land slides because of mountains and heavy rain.Due to which there is heavy loss to human resources.So we attempt a solution to this problem and thus generated an idea to monitor the factors the contribute to the landslides and perhaps can predict it. .**

I. INTRODUCTION

A. What is a Landslide?

A landslide is constituted by the sliding of debris or earth down a slope, facilitated by the force of gravity. The primary cause for all landslides is the failure of the constituent materials of the slope.A landslide is the movement of rock, debris or earth down a slope. They result from the failure of the materials which make up the hill slope and are driven by the force of gravity.

B. Factors leading to a Landslide

Primarily, a landslide occurs due to the action of the force of gravity along with the failure of the constituent materials to support the slope.However, there are multiple underlying factors which eventually lead to occurrence of a landslide. These factors might be natural or human induced.

1) Natural:

- elevation of water pressure in pores of the soil by slope material saturation due to intense or prolonged rainfall.
- seismic vibrations from earthquakes
- volcanic eruptions.
- Waves or river erosion.

2) Human:

- removal of vegetation, leading to increase in soil erosion.
- weakening of slope strength due to human construction such as roads, bridges, electric transmission architecture.
- mining and quarrying activities.
- excavation activities.

II. PROJECT

The Landslide Monitoring Device is an electronic device which can measure real time data, that is, measure physical and environmental variables pertinent to occurrence of landslides.The Device is further capable of transmitting this data instantaneously to another device.The device uses multiple sensors to achieve this objective.The device is placed at an intermediate depth of ten meters beneath the surface of the Earth.

A. Variables Measured

1) Acceleration: A MPU 6050 module(a MEMS accelerometer and MEMS gyroscope on a single chip) is brought into use to measure acceleration at different levels of depth beneath the top soil layer.Four MPU 6050's have been used in this device.Two of them are placed near the top soil,while the other two are embedded at variable depth beneath the top soil depending on soil,weather and environmental conditions.The top soil sensors basically act as first stage warning indicators,while the embedded sensors are intermediate and final stage indicators.Thus, the probability of occurrence of landslides increases with depth of the sensor for the same acceleration of the soil layer indicated by the sensor.The Inter-integrated Circuit protocol has been used for digital communication leading to acquirement of the accelerometer and gyroscope data.The delay period of variable measurement can be set depending on the needs.

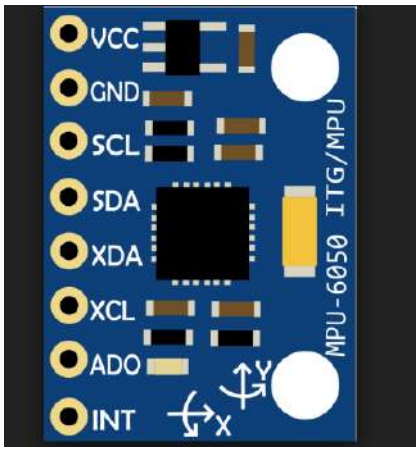

Figure 1. A MPU Sensor

2) Moisture: A YL69 moisture sensor is used for obtaining moisture values of the soil.The YL69 is a high quality sensor used to detect soil moisture.Moisture values indicate the soil water content, which plays a role in determining the holding strength of the soil supporting the slope,which

makes soil moisture a relevant variable in landslide prediction.Also,moisture changes of the net weight of the soil, and thus, is a major deciding factor as soil layers with weight more than a certain breaking limit is more prone to slipping.

Figure 2. A Moisture Sensor YL69

3) 3.Pressure: An FSR(Force sensitive Resistance) sensor is used to calculate the force being exerted by the mass of soil above the level at which the FSR has been placed.Accordingly, the pressure can be calculated in real time and pressure variations can be interpreted and further used in landslide prediction. [ht]

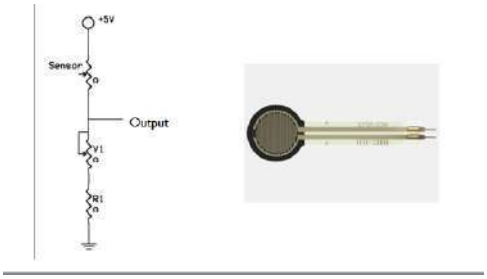

Figure 3. A Pressure Sensor FSR

III. The Electronic Circuit

- The MPU6050 were integrated into the circuit using the Inter-integrated Circuit serial protocol.Address pins facilitate the transmission of the variable data obtained in a delay cycle, where at an instance only one address pin of MPU6050 is held low while the others are held high.The device consequently obtains input from the MPU6050 whose address pin is held low.

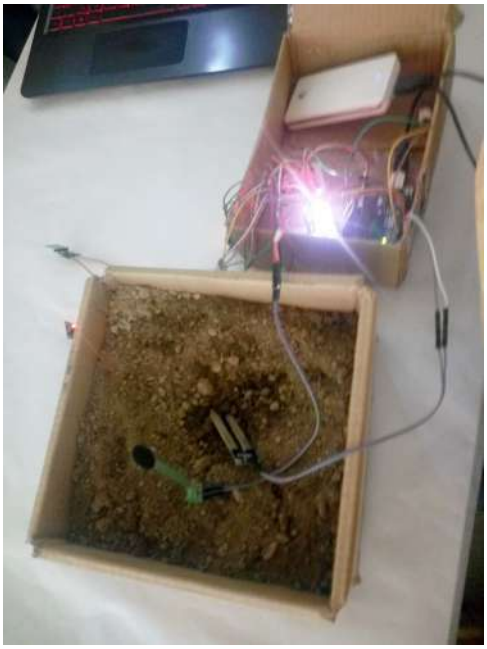

Figure 4. Landslide Monitoring Device

- The moisture sensor and the FSR are directly connected as analog input providers.
- The transmission module is a bluetooth module in the present prototype, which will further be promoted to a Global System for Mobile communication module which

will transmit data using the internet, and thus long distance transmission can be achieved.

IV. Research and Further Scope

Dr. Varun Dutt (Assistant Professor, School of Computing and Electrical Engineering, IIT Mandi) is currently working in an ongoing Himachal Pradesh Government sponsored project on the development of landslide prediction models along the "Kullu Manali Highway".He and his research team was consulted regarding the development and implementation of this project.There is ongoing work to implement this device in the project and use it for real time data acquirement, and further apply it to simulated landslide prediction models based on machine learning for prediction of landslides in the "Kullu Manali Highway".

V. Discussions

- This device will be integrated in the aforementioned project sponsored by the Himachal Pradesh Goverment on "Landslide Prediction in the Kullu-Manali Highway".
- The cost of one prototype currently comes out to be about Rs.2000.Furthermore, a GSM module will add about Rs.700 to the current model.
- The reception of this device in Aavishkar 2017 was positive where faculty members and students of IIT Mandi appreciated the real world application possibilities of the device, and it's potential to complement the development and implementation of machine learning models for landslide prediction was noted.
- The prototype developed has shortcomings in the form of absence of a long distance compatible transmission module.Further work on integration of a GSM module to fulfil these shortcomings is under process.

VI. Design

The basic structure having the Arduino, the transmission module, and the breadboard supporting the whole electronic structure is bedded in a waterproof, dustproof compartmental box.
The sensors are extended using high durability wires that stay intact in unfavourable weather and environmental conditions.
The compartmental box is embedded under the top soil, and two of the accelerometer cum gyroscope sensors are placed on the top soil, while the other two sensors are placed at varying levels of depth.Similarly, the moisture sensor and the FSR are embedded beneath the soil.
The Arduino Uno having the two SCL and SDL (supporting the Inter-integrated Circuit protocol) pins for incurring the acceleration data from the four MPU6050's.Thus, cost reduction was effectively achieved using the address based input protocol such that input from a single MPU6050 is acquired using the address based input method.

VII. Results

The prototype is a cost effective electronic device that can accurately predict certain variables that pertain to factors directly responsible for onset of landslides.Furthermore, better transmission integration on this device will lead to the production of a final product capable of being used for data acquirement and analysis which can facilitate the process of landslide prediction.Great amount of cost reduction was effectively achieved by integrating data procurement from four MPU6050 sensors using two SDA and SCL input pins via Inter-Integrated Circuit protocol.

VIII. Conclusions

The device is aimed at facilitating synthesis and implementation of real world landslide prediction models based on machine learning.
The device will be suitable for real world application after the implementation of a long distance transmission mechanism.
The device is cost efficient as a result of implementation of data procurement integration from four MPU6050 sensors using two SDA and SCL input pins via Inter-Integrated Circuit protocol.

Acknowlegement

Dr. Kunal Ghosh, Dr. Varun Dutt and Dr. Shrimali for guiding us throughout the project.

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Aavishkar 2k17
PICK AND PLACE VOICE CONTROL ROBOT

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May 23, 2017

***Abstract*—In this Project, we are trying to reduce labour work to drive the crane machine.For this we make voice controlled crane machine,which take commands from any Bluetooth device (in our case it is smartphone) and move accordingly. In this project we used Aurdino UNO, Motor drivers,wheels, Bluetooth modular,motors,wheels and wires. Bluetooth modular connect robot to Bluetooth app which is created through "Mit app inventor",and send voice commands to Arduino in form of text. Arduino is programmed through arduino app. At last our crane machine can perform the movements like "right" "left" "forward" "backward" "pick" "place" "stop" through voice and buttons.**

I. Aim of Project

To Make a affordable device that can be controlled by voice to pick and place the objects.

II. Components required

- Arduino uno
- Motor Driver
- Bluetooth Modular HC-05
- DC Motors
- Servo Motor
- Gears
- Chassis
- Wheels
- Battery
- Mini breadboard
- Jumper wires
- Software Serial library
- MIT app inventor

III. Details of Components

A. Arduino uno

We used Arduino in our project as a Microcontroller. Details are :

- Microcontroller board based on the ATmega328P.
- 14 digital input/output pins(6 pins are for PWM outputs)
- 6 analog input pins
- 16 MHz quartz crystal
- A Power jack
- A USB connection to upload the code
- A reset button
- Circuit diagram of Arduino with details is shown below:

Figure 1. Arduino Uno

B. Motor Driver(L293D)

We used Motor driver to give power the DC Motors. It receives signal from Arduino and rotate DC motors according to that signal.It has wide supply-voltage range from 4.5V to 36V .The diagram for motor drive(figure:2)r and IC L293D(figure:3) is given below:

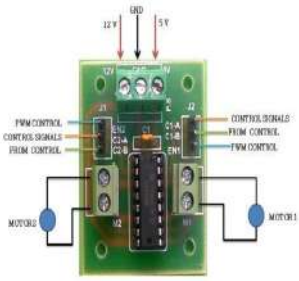

Figure 2. Motor Driver

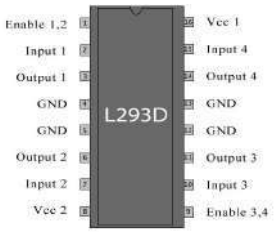

Figure 3. IC L293D

C. Bluetooth Module HC-05

- It is used for communication between Mobile phone and Microcontroller.
- Low Power 1.8V Operation,1.8 to 3.6V I/O.
- It receives commands from the user using a Mobile phone android app.
- Then, It transmits the commands to the microcontroller.
- Diagram of Bluetooth module HC-05(figure:4) :

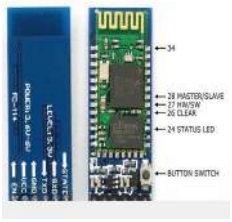

Figure 4. Bluetooth module HC-05

D. DC Motor

- 10 to 200 RPM 12V DC motors with Gearbox.
- 6mm shaft diameter with internal hole.
- No-Load Current=60mA(max).
- Load Current=300mA(max)

Figure 5. DC Motor

E. Servo Motor

The function of the servo motor is to receive a control signal from arduino that gives a desired output position of the servo shaft, and apply power to its DC motor until its shaft turns to that position. The servo motor has a 3 wire connection: power, ground, and control.These are connected to the arduino pins.

Figure 6. Servo Motor

IV. INTRODUCTION

A. Basic Introduction

It has always been a dream of human being to create machines that behave like humans. Recognizing the speech and responding accordingly is an important part of this dream. With the improvements of the technology, this dream comes true relatively. In this project, we are going to control a robot with speech commands. The robot is able to recognize speech commands given by user to move correctly.First we give voice command to the ANDROID phone. The android recognizes the command by speech recognition system. It converts these commands to text those are already defined by our robot. After receiving the command it moves accordingly.

B. The Need for Voice control Robots

Today most of the industries use wireless controlled robots to complete their works, which are made up of circuits.
As we know in today's busy life each and every industry needs to perform tasks without wasting their time.That's why they uses machines and one of them is crane machine which is used to lift the heavier object from one place to another place but this is a wireless controlled machine. It has some drawbacks like it needs more human effort to control it through their own hand, which makes them feel tired while doing lots of work.But it's possible to overcome these limitations by using mobile phones because they provide so many advantages, like working range of machine can be increased as large as the mobile network coverage area.
That's why we made an android controlled mini crane robot which works in the same as of pick and place robot and it can be easily controlled using voice commands.For this purpose we use bluetooth controlled app.

C. Speech recognition

Speech recognition is the ability of a machine to identify our spoken words.It converts those words to a format of machine.For making voice controlled robot, we do the speech recognition process in our robot, so that it can be identify ou words and respond according to it.
Now comes to it's advantages:-
1. Speech is a very natural way to interact, and there is no need to sit at a keyboard or work with a remote control.
2. No training required for users.(user friendly)
Disadvantages:-
If there is noise or some other sound in the room then robot

has problems to read the voice properly and the number of errors will increase.

D. Android system

We build our own mobile app to control our Robot from MIT App Inventor. It is an innovative beginner's introduction to programming and app creation that transforms the complex language of text-based coding into visual, drag-and-drop building blocks.
It is an online app maker which has inbuilt functions like bluetooth client which connects our app with bluetooth modular, speech recognizer which recognize our voice and send it to our Robot through bluetooth connectivity . It also includes some built in blocks like controls, logic blocks, text blocks, colors blocks, etc. In addition to voice control we also made our Robot Remote control for which we made forward , backward, left, right, stop, Up ,Down buttons in our app. when these buttons are clicked the app sends text command to Robot. A screenshot of our app is given below in the figure :

Figure 7. Voice control app

V. PROCEDURE

- Our project was to make a Voice control robot , that can lift the objects and move them from one place to other place.
- First, We collected all the components required for our project.
- Then, We draw a block diagram of connections for Robot, that is give below in the figure :
- It has two parts:-
  1. Voice control robot
  2. Lift and place

  These two are mentioned below in details :

A. VOICE CONTROL ROBOT

- According to our block diagram we connect the components.
- We send voice commands to bluetooth module by an android app that is mentioned above in report.
- We use Arduino that receives those commands from the bluetooth module and transfer it to other components.
- After it, Arduino transmit the commands to Motor driver that runs the DC Motors accordingly.
- Due to DC Motors, Our Robot moves forward, back, left, right and stops.

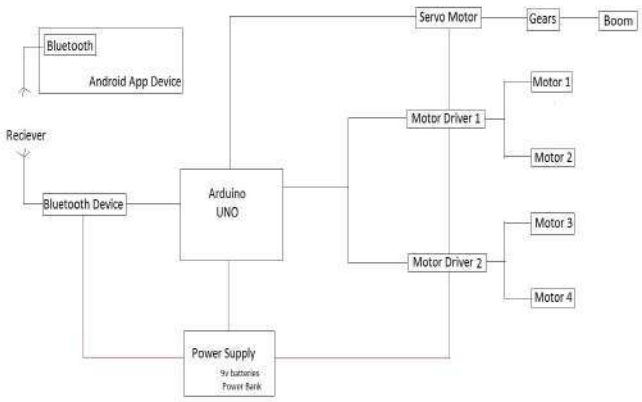

Figure 8. Block diagram for Voice control robot

B. LIFT AND PLACE

- We made a manual setup for the crane in Mechanical lab, that is shown in figure :

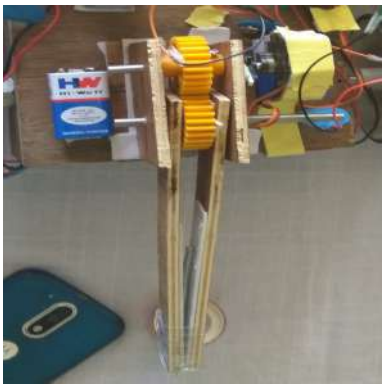

Figure 9. CRANE SETUP

- We follow same process to send commands to our project those are mentioned above.
- After it, Arduino transmits the commands to Servo Motor.
- Servo motor rotates according to our arduino code and move up and down.

VI. OBSERVATIONS

- Speech recognition controlled wireless robot was designed using speech recognition module.
- We use big tires for it because it is used in construction area.
- It can be operated by voice as well as remote too.
- It can move "right" "left" "forward" "backward" and "stop".
- It can be also perform function to lift the objects and take them from one place to other place using commands "up" and "down".

- Some pictures of our robot are given below :

Figure 10. Robot(Top view)

Figure 11. Up and Down system

- You can also refer to this link to see the demo of our project: (https://drive.google.com/open?id=0B6U9I9TyzgnqNm9jMXJBdmpHcTA)

VII. Results

- Our project idea was to make a voice controlled robot which can carry things from one place to another place and we successfully did it.
- Functionality of our robot can be divided into three parts: 1. The speech recognition system, that is responsible to understand spoken words.
  2. The robot controlling part, which is responsible to follow commands given by user. 3. The pick and place setup, that lifts the objects according to our orders.

VIII. Conclusion

- Bluetooth is a short range communication device from fixed mobile devices.
- We have developed the idea of voice recognition system into robotic vehicle which can help of disabled people.
- Our robot can understand Voice commands spoken in a natural way.
- In our project, we use HC-05 bluetooth module and To pair it with mobile, we use pass code ”1234”.

IX. Discussion

- We discussed our project with Indresh Sir(2nd year), He gave us idea to create our own voice app to control the robot.
- I would also like to say thanks to Ankush Bag Sir, who gave us idea to do some mechanical work on our project, so that we can reduce the cost of our project.

X. Applications

- The robot is useful in those places, where humans find difficult to reach but human voice can reaches. E.g. in a small pipeline, in a fire-situations etc.
- By this project, we can reduce human efforts, that makes our life easy.
- The voice controlled robot has important application in industries where user can control the robotic vehicle via voice commands.
- Crane can be used to make big buildings. In that we can lift heavy loads and move that from ground to other floors.we can also carry it from one place to other place.we do this with our voice.
- It can be used as a toy for children.
- Menu driven systems such as e-mail readers, household appliances like washing machines, microwave ovens etc. will become voice controlled in future.

XI. Cost of the project

- The total cost of our project was approximately Rs 2500.
- We did some mechanical works to make chassis and setup for lift and place.
- To make our project on a large way, Cost depends on size of machine.

XII. Precautions

- We should use components carefully otherwise they may be shorted.
- We should use a different battery to give power to Motor drivers and Servo motor, so that every component can get enough power supply.
- Don,t Speak to fast but also not to slowly.
- Try to speak English word propely, so that it can understand easily.
- Wires should be connect properly in arduino pins.
- Connections should be neat and tight.

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AAVISHKAR 2K17
Pick and Place Robot

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***Abstract*—Man has always tried to give its invention human like abilities to help him in his works. To improve our living, mankind have invented many types of robots which has proved to be very helpful to him. One of these include pick and place robot. The design of an Android Controlled Pick and Place Robotic vehicle has been presented in this report.The robot can move around in four directions and has a gripper for pick and place operation. These operations are controlled by an user friendly android app available on operators mobile phone. Depending upon the button clicked on the application,commands are given to robot by micro-controller.This robotic vehicle may be used in industrial or even domestic purposes.**

I. Introduction

The pick and place robot is a machine which is capable of carrying and placing items from one location to another by receiving commands via a mobile app and carrying out the necessary series of actions automatically.

II. Apparatus Used

The components required for the assembling of the robot are:

- A Metal chassis
- 2 Plastic wheels
- 12V Power supply
  12V power supply is used to supply power to arduino uno and motor drivers.

- 3 DC motors
  Two five hundred rpm motors(to run the bot fast) and a single 60 rpm motor for the opening and closing of the claw.

- Arduino Uno: Arduino UNO in very simple words is a small computer which can be programmed via the Arduino IDE which makes it possible to write code regarding the tasks to be carried out using Arduino board and upload the code to the micro-controller.[4]

- Servo motor: A servo motor is an actuator that allows for precise control of angular position, velocity and acceleration. It is a combination of a DC motor and an IC to interpret signals from the controller device.The controller device determines when and how the servo motor will move.[4]

- Bluetooth module: Bluetooth module is a small PCB which contains bluetooth processors on it.
  The bluetooth module makes it possible to communicate wirelessly with the microcontroller using a bluetooth capable device.[4]

- Motor drivers: Motor driver is a device that acts as an intermediary between the robots microcontroller and motor. The motor driver acts as a current amplifier for the motor.

III. Motivation

The reason we choose this project was that in today's industry many occupations like automobile industry, food industry, agriculture, etc. have monotonous and strenous activities, that can have seriously affect the health of humans, which can done by the use of pick and place like robots. These robots have high efficiency as compared to humans and these do not feel exhausted. It can work for twenty four hours a day, seven days a week, with higher efficiency and thus decreasing cost involvement in the long run.Moreover, these kinds of work can be done easily using a single pick and place robot, which can used for both loading and unloading purposes. Another reasons for choosing this project involves its security features as this robot can be used to dispose bombs safely to far off places.[3]

IV. Working

The robot is controlled by the bluetooth enabled device at the transmitting end with the help of an android application, which sends signal i.e. ASCII code to control the movement of the robot either to move forward, backward and left or right.The application is also used to send signals to the Bluetooth module which is employed as an interface between

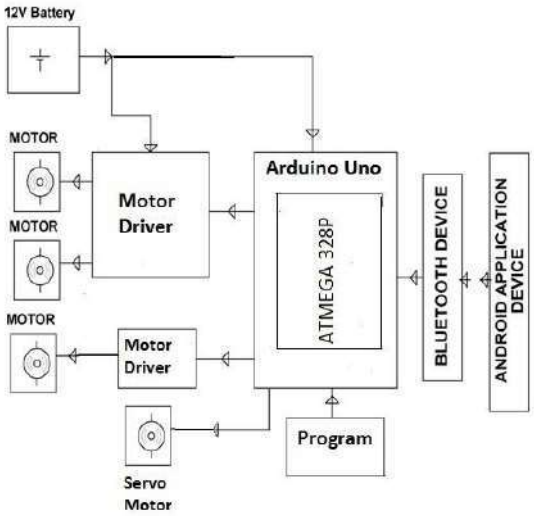

Fig. 1. Circuit diagram schemmatics

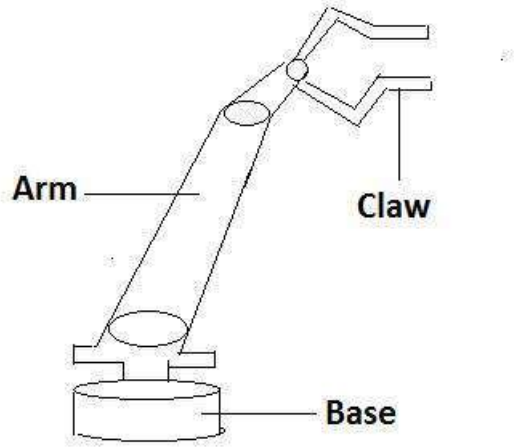

Fig. 2. Schematic diagram of claw

the controlling device (Mobile/Tablet) and the robot. At the receiver side four motors are used, two to drive the robot and the other two used to control the arm movement and gripper movement. The micro-controller controls the motors, with motor drivers acting as an interface between the motors and the micro-controller and hence the wheels and the picking arm of the robotic vehicle function.The wheels underneath the base help to move the robot to the desired location.The rigid body supporting the clipper bends or straightens up to reach the position where the object is placed. The clipper picks up the object with a strong grip and places it at the desired position.[3]

The link for showing the video of functionality of robot
https://drive.google.com/open?id=
0Bz1TWGgGPw4jRnI1SW5VR3JreGM5

V. Applications

- Robotic pick and place automation system helps in the process of picking parts up and placing them in new locations thus increasing production rate.These pick and place robots are more accurate and do not fatigue while doing back-breaking or hard to manoeuvre movements that may be difficult for humans.
- As these robots are consistent, they can be easily programmed and used to provide multiple applications if required.
- Smart version of pick and place robot are used to deliver mail in offices and medications in hospitals.
- Pick and place robotic arm can used for teaching purposes.[2]

VI. Block Diagram

The project contains 2 sections.On the receiver's end is the robot while on the transmitting side or controlling side is the cell phone/tablet having bluetooth facility.The block diagram of the project is as shown in the figure.

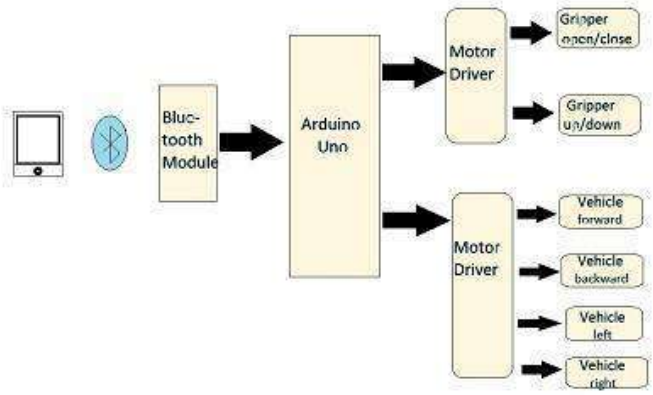

Fig. 3. Block Diagram

On the transmitting we give command through an Android application.every button in the android app is assigned a key .so when the button is presseed the Android Application send the key to bluetooth module through which it commands to arduino and and our Arduino follows the command according to the code.[5]

VII. Future Scope

The future scope applications of this project includes:

- This robot can be used in nuclear laboratories to handle toxic chemicals which are harmful for humans and can prove fatal sometimes.
- With slight modifications in the design,this robot can also be used for helping the physically challenged people.
- After few modifications we can use the robot in bomb defusion. If a web cam is used, we can control the robot to defuse the bomb without putting human life in danger and in this way this can be used to counter terrorism.[5]

Fig. 4. Screenshot of Android Application

VIII. Conclusions and Discussions

In the whole procedure of our project work completion we have successfully build android based robot with pick and place robot application. In the completion of our project we have used softwares like Arduino IDE, MIT app inventer. The final output of our project is robot controlled via a android application.The robot has been able to pick up the object and place it effectively. It is also able to perform lifting upward and downward operation smoothly.Beside than that, the adjustable gripper is able to open its claw according to the instructions provided by the user.

IX. Result

The design of a Robotic Vehicle which is controlled by android application has been completed. A prototype was built and confirmed functional as per our requirements. This would

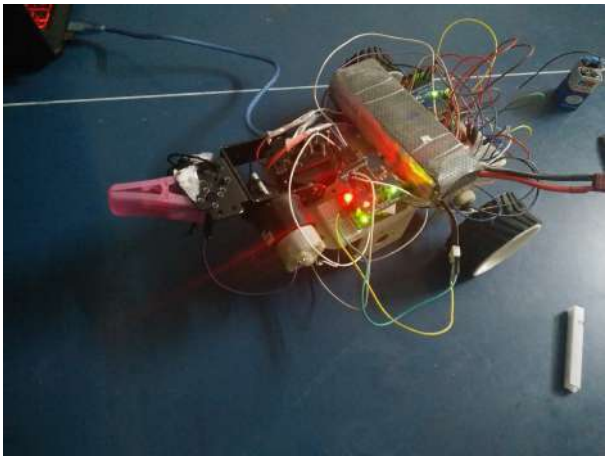

Fig. 5. Pick and place robot

make it easier for man thus decreasing the risk of handling suspicious objects,which is be hazardous in its present environment or in the workplace.This design would help to carry out complex and complicated duties at a faster rate and more accurately.

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Aavishkar Report 2017
Manual-cum-Automated Fire Fighting Robot with Camera

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***Abstract*—This project deals with the designing of an autonomous fire fighter robot which is able to detect,find and extinguish the fire.It is controlled using Arduino and RF module.The 4 wheeled robot contains heat and Flame Sensors,DC motors,Pump.The software part of the project is program code written in Arduino IDE.**

I. Aim of Project

Make a prototype of Fire Fighting Machine which has two modes namely, Automated and Manual. Manual controlling is done by remote by the user. Whereas in automated mode it detects the fire itself and puts it off.

II. Equipments Used

- Arduino Uno 328PU - 3
- L293D Motor Driver - 2
- DC Motors 100RPM 2Nm - 4
- Rf-Tx Module - 1
- HC-05 Bluetooth Module - 1
- OV7670 Camera Module - 1
- D2018 Flame Sensor - 3
- D2016 IR Sensor - 1
- DC Pump 12V - 1
- Tyres for Vehcile - 4
- Resistances
- Jumper Wires
- Chasis for Body
- Push Buttons
- PCB

III. Theory

In designing the prototype, various components are used. They all are needed for the smooth functioning of the bot. There are lot of feedback circuits. They help to process to data received and perform various operations accordingly.

Brief Description of items used:-

- **Arduino Uno 328PU**
  Arduino Uno is a microcontroller board. It has 14

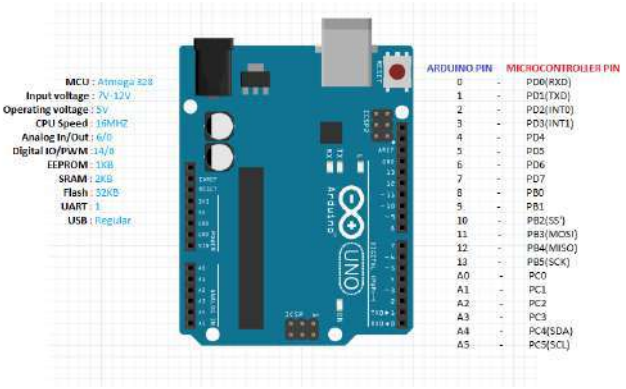

Figure 1. Arduino Uno Pin Layout

digital in/out pins, 6 analog inputs,having a 16 MHz frequency, and a reset button.Reset buttons deletes the previous content uploaded on board.To power it, a USB jack and a DC adapter port is available.It can be operated conveniently on 9V DC voltage. Its programming is done in open source Arduino IDE available at arduino.org. Programming is very simlilar to C.

- **L293D Motor Driver**
  This module is a motor driver used for driving DC motors. This consist of L293D H-bridge motor driver IC. It can drive 2 DC motors in both the directions simultaneously. There are 4 logic pins coming from Arduino and a 5V and GND pin to power it.The maximum external voltage to drive the motors is 36V. The maximum electric current output for a particular

Figure 2. L293 Motor Driver

motor pin can go upto 600mA.

- **Rf-Tx Module**
  Rf-Tx module operates using Radio signals.Transmitters

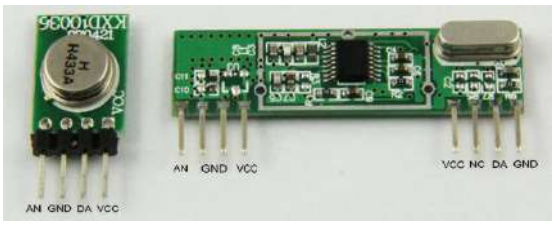

Figure 3. Rf-Tx Module

and Receivers communicate using the carrier radio signals of 434MHz.It range goes up-to 50m in open space, without any obstacle. Whereas in case of multiple obstacles it is able to send signals up to 15m.Data received from micro-controller is carried on modulated radio signal generated by transmitter.R-f module demodulates the received signal and feed to other end micro-controller.

- **OV7670 Camera Module**
  This camera module needs a single +3.3V power sup-

Figure 4. OV7670 Camera Module

ply.The OV7670 camera module is a relatively cheap 0.3 mega pixel color camera module, it can give an output of 640x480 VGA resolution image at a threshold of 30fps.It has total no. of 18 pins out of which 8 are used to send the digital form(converted from the raw video captured by camera) of the video to the arduino.Their are other pins like reset, clock, GND , PWDN,PWUP etc.

- **D2018 Flame Sensor**
  The D2018 Flame sensor module is used to detect

Figure 5. Flame Sensor

fire flames. It has one 5V, a GND and one analog output pin.It gives analog inputs to the arduino. It finds the wavelength of the infrared waves emerging from the flame and feed it to arduino input pin where it is connected. If the read wavelength lies between 650 to 1000 nanometers the led in front of sensor switches on shows that flame is detected.And we can program arduino accordingly.

- **D2016 IR Sensor**
  The D2016 IR sensor module has an infra-red

Figure 6. IR Sensor

transmitter which lights up the surroundings and an infra red receiver which measures the amount of infra red that is reflected. It works on the percentage of light reflected back.If the reflected light percentage goes above a certain threshold(¿700)then the led switches on and it finds an obstacle and feed the data to arduino. We can program arduino accordingly.

Our Project has been divided into three major segments:-

- Working of Camera to get live video feed.
- Setting up the Remote with Tx Module and Arduino.

- Setting up the Receiver Side with Rf Module and connecting the sensors to send and receive analogue and digital data from various components connected.

A. Working of Camera Module

Image processing mode of the camera has been set to YUV. In this mode, each pixel is encoded in two bytes. The first byte encodes gray scale, and the second byte encodes - color difference.We only considered the grayscale values. This was due to the processing of Arduino was not much compatible with the camera module.

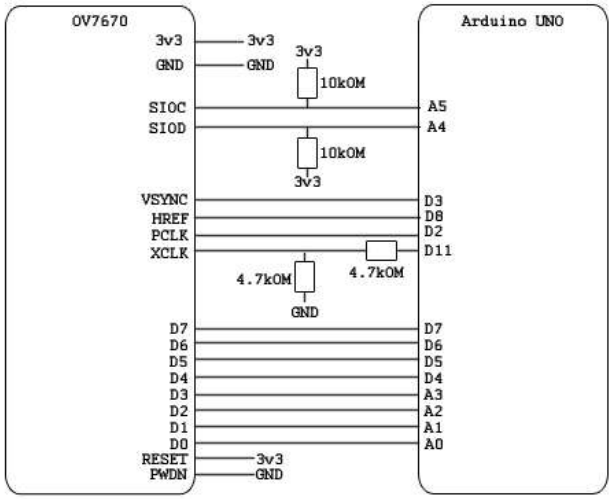

Figure 7. Interfacing of Camera and Arduino

The code was burnt in the Arduino to process the raw data obtained from the camera module.
Next step was to transfer the data obtained from the camera on a display device. An Android mobile application was used to display the data received. This was acheived by transferring of data from the bluetooth module. Bluetooth module was renamed using AT Commands. This was done due to requirement Android Application. Baud Rate of Arduino and Bluetooth Module matched highest at 230400. At this baud rate maximum transfer rate that could be acheived would be 234.0kbps.

B. Working of Remote

Remote had to be made from the push buttons. The buttons on the PCB included for manual control forward,left,right,backward and stop. Additional functionality buttons included switching the the modes between manual and automated.

Arduino is used as a encoder at the transmitter side to encode the single byte of data and then sends it to Tx module which is later on transferred via Antenna to Rx module.

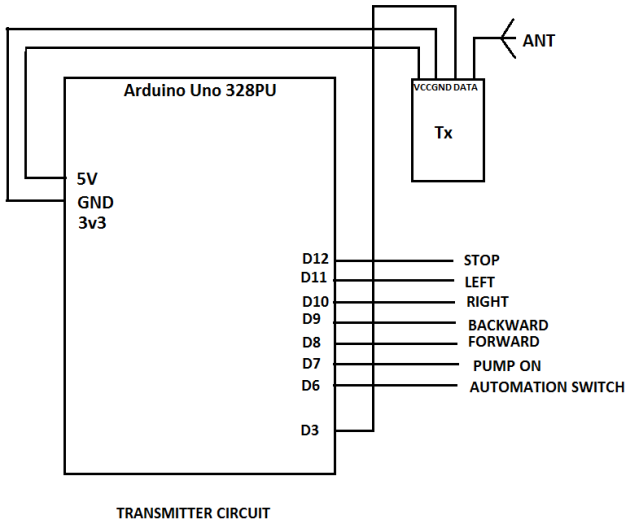

Figure 8. Interafcing of Tx module with Arduino

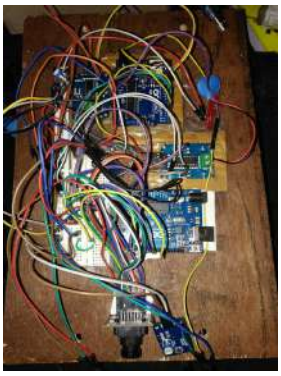

Figure 9. Internal Main Circuit Board

C. Receiver and Main Circuit Board

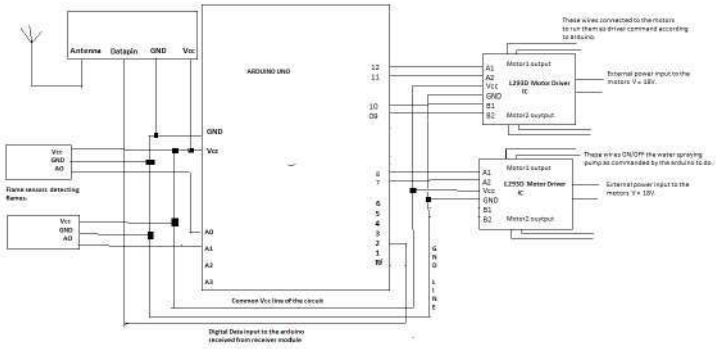

Figure 10. Interfacing of various sensors and Rf Module in Main Circuit

In the manual mode commands for locomotion of vehicle is sent remotely.This message is received by Rf Module. This message is then decoded and fed to Arduino. On the basis

of the commands received the body moves around accordingly.

```
void automatic(){
     Serial.println(count);
     while(count<40000000){

           if(analogRead(A5)>550){
              left();
              delay(2000);  //************************************************
              fire();
              left();
              delay(2000); //************************************************
              fire();


           }
          else if(analogRead(A0)<550&&analogRead(A2)<550){
                fwd();
                count++;
           }
          else if(analogRead(A0)>550&&analogRead(A2)<550){
                 bwk();
                 delay(1000);
                 right();
                 delay(2000);  /* accroding to half time of right turn*/
                 fire();
                 right();
                 delay(2000);  /* accroding to the half turn of right*/
                 fire();
         }
```

Figure 11. Code Snippet and Algorithm for Automation

Whereas in automated mode,raw data from various sensors used is processed on a predefined algorithm. This algorithm helps in decision making.

IV. Procedure

- Design the body of the fire fighting vehicle using mechanical tools.
- Install the wheels,motors and pump to the body.
- Set up the remote using push buttons,connecting wires,Tx module,PCB and Arduino,as per the circuit in the theory.Ensure that all the push buttons are grounded.
- Set up the receiver side using Rx module and Arduino.
- Connect the motor drivers to Arduino.
- Connect respective output pins of the motor drivers to motors and pump.
- Connect the IR sensor to detect obstacle in automated mode.
- Install the flame sensors on front,left and right sides of body to detect the flame and to deliver analog raw data to Arduino.
- Install the camera module.Make its connections to Arduino as per circuit given in theory carefully.
- Install the bluetooth module to display output of camera on display device.
- Rename the bluetooth module using AT commands.
- To get the output on the display device install the Android Based Application..
- Turn on bluetooth of android device and search for the bluetooth module named "Merl1nVision" and pair with it.
- Open the installed android app and you can check for the output of the camera.
- Now you can switch between auto and manual mode to control robot.

V. Result

- Robot is able to be controlled in manual or auto mode as per requirement.
- Live feed of the camera plays a great role in controlling the robot and to get acquainted with the condition of sorrounding area of robot.

Figure 12. Getting video from Camera Module via Bluetooth frame by frame.

- The output of the sensors used drives the robot in auto mode.
- Pump sprinkles the water at the fire place according to the output of flame sensors or as per the command given through remote.

VI. Conclusion

This robot can proved to be very handy in dangerous conditions and a saver of human lives.It can be used in the worst conditions where firemen can't go and their lives will be at stake.

For better quality of live feed Raspberry pi can be used instead of arduino. To save robot body from fire,its part can be made from high temperature sustainable material.

References

[1] Instruct Tables, "Basics Idea about Connection about Receiver and Transmitter"
[2] Instruct Tables, "Working of Flame Sensor"
[3] El-Pro-Cus, "Working of IR Sensor"
[4] Github, "Source Code of Android Application"
[5] Blog Eggheads, "Working of Camera Module"
[6] Blog Eggheads, "Connection of Bluetooth Module to get Video Feed"

Aavishkar Project Report
THE EYEWRITER

***Abstract*—Diseases such as ALS(Amytropic Lateral Schlerosis) leave a person completely paralyzed and bedridden. Paralysis is a highly prevalent problem in India presently. Such patients seldom have any means by which they can communicate with others. As a project for AAVISHKAR'17, keeping in mind this problem, our group has built a device we call the EyeWriter which allows its user to use his/her pupil movement to communicate or even draw on screen. The device was built using easily available materials and costs less hence making it easily available to all. The device uses a PlayStation eye camera and near IR(Infrared) light to track the user's eye movement and generates a corresponding output on an open source software on screen. This device could bring about a change in the way in which paralytic patients can communicate with others.**

Fig. 1. A user using the EyeWriter.

I. Parts used

Following are the materials used for making the hardware part of EyeWriter:
1) Micro CCD camera(PlayStation Eye Camera) Refer to Fig. 2.
2) Spectacles frame
3) IR filter(from floppy disk)
4) IR LEDs(Light Emitting Diodes)
5) Printed Circuit Board(PCB)
6) Aluminium Wire
7) Solder Wire
8) Battery
9) Wooden blocks and metal pieces.

Fig. 2. PS camera used in our device.

II. Introduction

STATISTICS reveal that there are around $9,585,635$ paralytic patients in India. Prevalence of Amytropic Lateral Schlerosis(ALS) in India is 6 persons out of every 1,00,000 persons. Such diseases leave a person completely paralysed and bed-ridden with no movement of any body part nor is a person able to speak. To help such persons communicate, we made a device called the EyeWriter which uses the motion of pupil of our eye to write or draw on screen.

It uses a camera placed in front of the eye to take a black circular spot as an input which is nothing but the pupil of our eye. This input is taken by the EyeWriter software which converts it into a white spot and then calibrates our position to turn the pupil of our eye to a cursor. Now the magic happens. It is our eye which can write, draw and communicate. Just as we control the cursor of a laptop with a mouse using our hand, in a similar way, in this case it is the eye which controls everything on screen.
A very basic model of our project is given in Fig. 3.

III. Objectives and Social Impact

(1) Paralytic patients can communicate using this device.
(2) We have tried to make a low cost device which can be made available to all.
(3) Our device is made using commonly available tools and its components are easily available in the market.
(4) It can help the police record statements of handicapped patients in hospitals after accidents.
(5) Its implementation can be done in gaming to make gaming more realistic.

Fig. 3. A basic model of our project.

IV. Steps involved in making structural framework of EyeWriter

The making of Eyewriter basically involved following 3 steps which are explained in detail. For clear understanding, refer to Fig. 4.

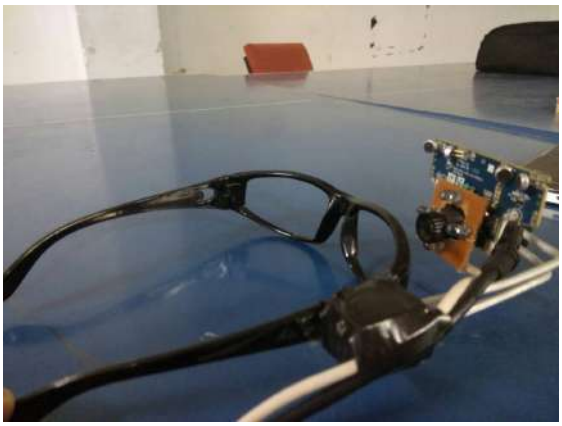

Fig. 4. Structural framework of EyeWriter.

A. Hacking the PS Eye Camera and making it sensitive to IR

1)We unscrewed the four screws on the back of the PS3 eye and cracked open the case.

2)Then we unscrewed the screws that mount the camera circuit board to the plastic housing and unscrewed the camera lens mount as well.

3)We removed the visible light filter(which blocks IR) from the camera and attached a small piece of IR filter (which we cut out from a floppy disk) in its place. Now the camera is sensitive to IR light.

B. Soldering IR LEDs on PCB

1) We cut a PCB(printed circuit board) into a small square section and cut a circular section inside it so that the camera goes inside it.

2) We then soldered 4 IR LEDs in parallel on it using soldering iron and attached the ends to a battery connector.

C. Attaching the camera and PCB to the spectacle frame

1) The camera arm not only needs to hold the camera rigidly in front of one eye, but must also be flexible and positionable.

2) So using wooden blocks and tape we made a small support for the camera and joined it to the spectacle frame using a long aluminium wire.

V. Working

1) The IR LEDs are lit up using the battery and are used to illuminate the eye.

2) The IR light bounces off the eye and reaches the camera.

3) The IR sensitive camera captures the iris of the eye as completely white and the pupil as a high-contrast black dot.

4) This is taken as input by the EyeWrite software and it converts this black dot into a white dot and then the callibration process begins.

5) The calibration part of the software displays a sequence of points(25 in this case) on the screen and records the position of the pupil at each point. It is designed so that a person wearing the glasses should focus on each point as it is displayed without moving his head. When the sequence is finished, the two sets of data are used to interpolate where subsequent eye positions are located in relation to the screen.

6) After proper calibration, the eye now becomes the cursor and the user can communicate via it.

7) We included 3 modes in the software:
The Drawing mode: Here the user can draw anything using straight lines. A vertex is made on screen when the user looks at a spot for more than 0.3 seconds and two consecutive vertices are joined by a line.
The Tiles: These are used for telling about basic necessities of a patient like taking medicine, drinking water, going to sleep etc. We have also added an audio feature in this mode.
The Basic ping-pong game: This was basically included for fun and to show implementation of this device in gaming applications.

8) The user has to look at a button for more than 0.3 seconds for it to get clicked or selected.

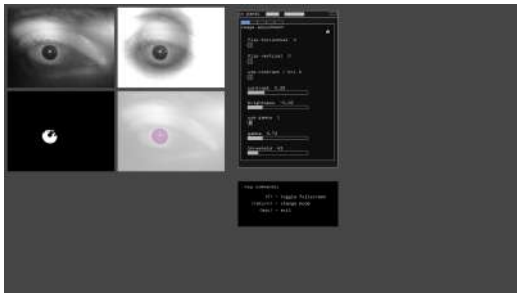

Fig. 5. Eye adjusting part of eye tracking software.

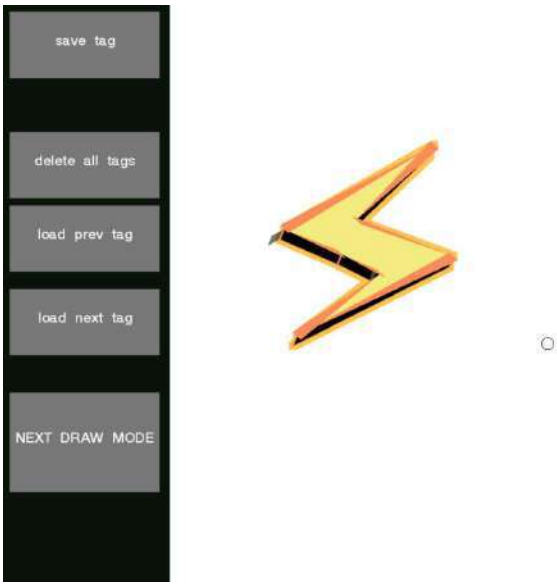

Fig. 6. A letter made using drawing mode of Software.

A. About the software:

The EyeWriter software is in two parts- an eye-tracking software and a drawing software designed for drawing with eye movements.
The software for both parts has been developed using openframeworks, a cross platform C++ library for creative development.
The eye-tracking software detects and tracks the position of a pupil from an incoming camera image, and uses a calibration sequence to map the tracked eye/pupil coordinates to positions on an output screen. The pupil tracking relies upon a clear and dark image of the pupil. The device we designed uses near-infrared LEDs to illuminate the eye and create a dark pupil effect. This makes the pupil much more distinguishable and, thus, easier to track. The camera setting part of the software is designed so the image can be adjusted with brightness and contrast to get an optimal image of the eye.

The github link of the modified code after removing bugs and making changes:
https://github.com/Lasers67/OculoScripter

Fig. 7. Tiles for basic necessities.

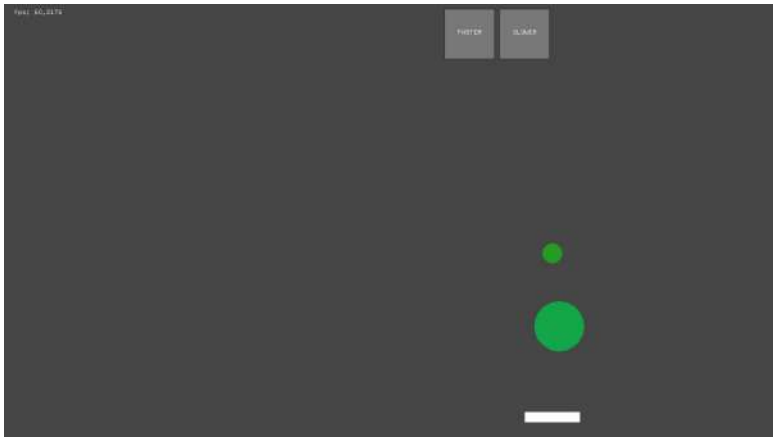

Fig. 8. A ping-pong game where motion of platform is controlled by eye.

B. Why we used only IR light?

(1) The use of a light source in the scene enhances the quality of the image and facilitates detailed image analysis and gaze estimation.

(2) Infra red light is not visible to the human eye, hence the light is comfortable for the user and does not distract attention.

(3) When you illuminate the eye with IR light and observe it through an IR sensitive camera, the iris of the eye turns completely white and the pupil stands out as a high-contrast black dot. This makes tracking the eye much easier.

VI. Conclusions

(1) The EyeWriter uses the application of near IR light to illuminate the eye and uses a micro CCD camera which has been made IR sensitive to capture a precise image of the pupil. Though it doesn't pose any serious harm to the user, continuous prolonged usage of this device without a break could lead to damage to the eye due to the heat produced by the infrared light.

(2) The user interface of the software can be modified according to the user's need.

(3) The software, being open source, is under constant development and gets better by the day with more features for patients.

(4) On the whole, costing less than a bare Rs 1500, this device can be easily afforded if made available to the common people. It can bring about a change in the way in which paralyzed people can express their needs to the people around them.

VII. Results and Discussion

(1) The successful making of eyewriter will lead to a whole new way by which paralytic patients can communicate. This is a great innovation for such people to give freedom to expres their thoughts.

(2) Since its cost is less than Rs. 1500, it results in this device being made available to all.

(3) Advancements in EyeWriter can be made to include many more features like a virtual keyboard for typing etc.

(4) Its advanced used in gaming can make this technology be used by all and not just paralytic people and making gaming more exciting and realistic.

(5) This project increased our knowledge about the number of paralytic patients in the world and gave a real motivation to improve their lives by making this small contribution.

(6) Our knowledge about cameras and different filters used in it increased and we came to know more about properties of visilbe light and IR light and how to track eye using eyeWriter software.

References

[1] Statistics taken from: http://www.rightdiagnosis.com/p/paralysis/stats-country.htm and http://www.rarediseasesindia.org/als

[2] Github link of source code: https://github.com/eyewriter/eyewriter-1.0