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SMART ROBOTIC ASSISTANT (FLAPPY)

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ABSTRACT

All of us can clearly see that the world is changing and growing rapidly in terms of robotics and automation technologies and we can take advantages of it for making human life much easier and more effortless. So, we have tried to achieve that goal by developing a smart robotic assistant named as "Flappy". A robotic assistant is a robot which assist or helps someone to do the daily chores in a more effective and simplest way. It can perform several types of tasks given by the user either with the help of voice commands or by a remote-control device (laptop, smartphones or wireless keyboard). The robot is using an android tab as its brain, it also provides a display and touch interface to user. An Arduino MEGA board has been used for controlling the movements of motors and taking data from sensors. A Bluetooth module (HC-05) is also connected with the board for controlling it directly by a remote device. These robots are also very helpful in the medical and educational fields for helping physically challenged persons and teaching students remotely from far a distance. These types of robots have already proven their importance in COVID-19 pandemic crisis too.

Keywords:*Smart, Assistant, Robot, Arduino, Android, GUI.*

1. INTRODUCTION

As we know life of people are very busy and generally there are so many tasks to do for everyone at daily basis. So, they have lack of time to complete the same and that's why they feel need of someone who can assist them in some repetitive & regular tasks and help them to manage their works. Here we have tried to make a **Smart Robotic Assistant,** an assistant to help in our works in several ways. In this research paper we have discussed about developed of a smart robotic assistant (named as **FLAPPY**) that operates on voice commands given directly to it and can also performs some basic operations which are predefined in its controller memory. An android tab has been used as the brain of robot which also provide a **GUI** for user interface and the android app, we have used in has been developed by using MIT app inventor tool (web based app development platform), for controlling motors and taking data from sensors we have used an Arduino MEGA board which is connected with the android tab using a serial communication cable, the arduino bord also has a Bluetooth module connected to it on its another serial port for direct control of the robot using a remote device (i.e. android smart phone, laptop or wireless keyboard) by the user.

2. WORKING

The SRA (Smart Robotic Assistant) "Flappy" can work in two modes automatic and Manual (User Controlled) In automatic mode the robot can run all the functions predefined into its controller memory like- moving in different directions according to obstacles avoiding sensors data and answering the questions asked to him. In manual mode the robots behaves according to user inputs whenever user gives any voice commands to the robot the speech to text conversion operation comes in action and converts user's voice commands into text format, the text datafurther get processed to generates serial data for controller unit this datathen transferred to the main controller using a USB cable, the controller already has all the functions predefined into its flash memory, whenever any prefixed serial data received by the controller, its triggered the specific functions attached to that serial data like picking up any object, call to some, sending e-mails or SMS etc. the robot can be also controlled by a external controller device that can be a laptop, any smart phone or wireless keyboard in that case the control device need to pair with the Bluetooth module (HC-05) which is directly connected to another serial port of the control unit and the user can directly send the serial data to the robot and control it accordingly. Hence the working of the robot is quite simple and the behavior of the robot can also be change according to user's need by just changing some lines of codes of the control unit. Also, the design of this robot is modular so it can be easily modified of upgraded and gets more future friendly.

3. METHODOLOGY

The flow of program and operations of the robot has been shown if the flow chart of fig-1 and fig-2. Whenever any voice commands given to the robot its brain decides that what serial data it has to send to the control unit. The control unit then generates control signals for the correspondence control devices.

3.1 Flow Chart

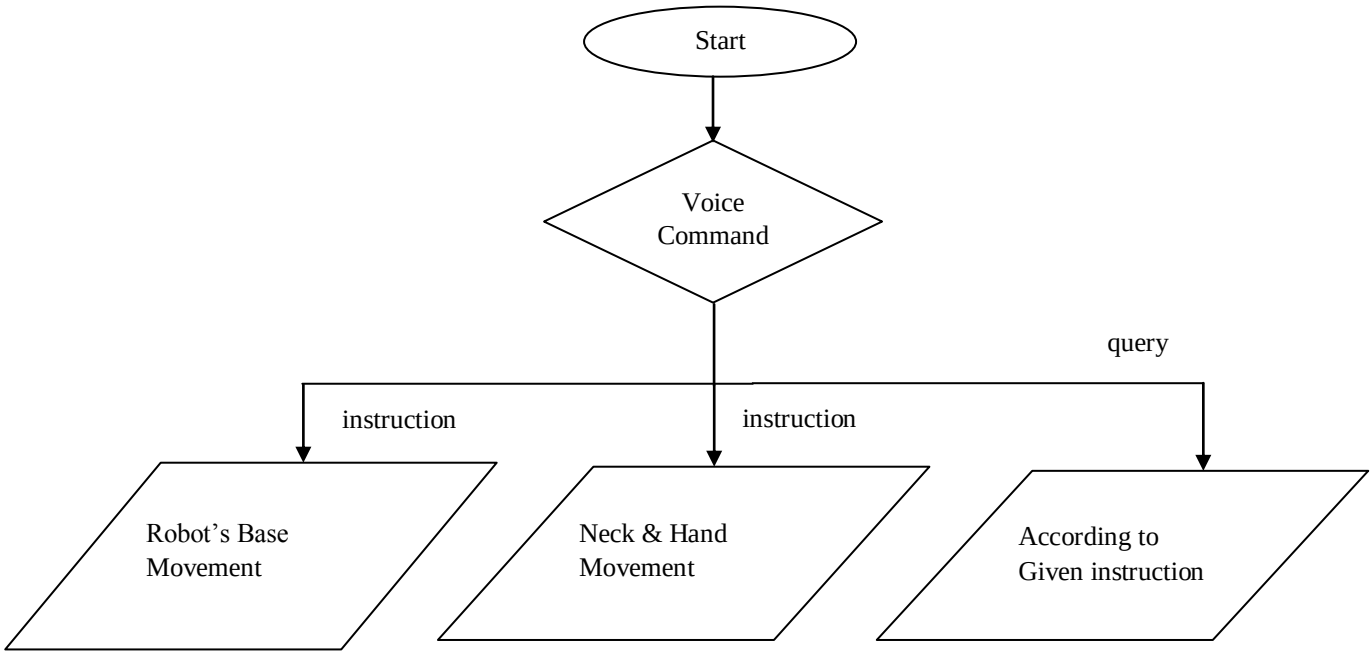

Fig-3.1: Flow Chart for Query and Instruction

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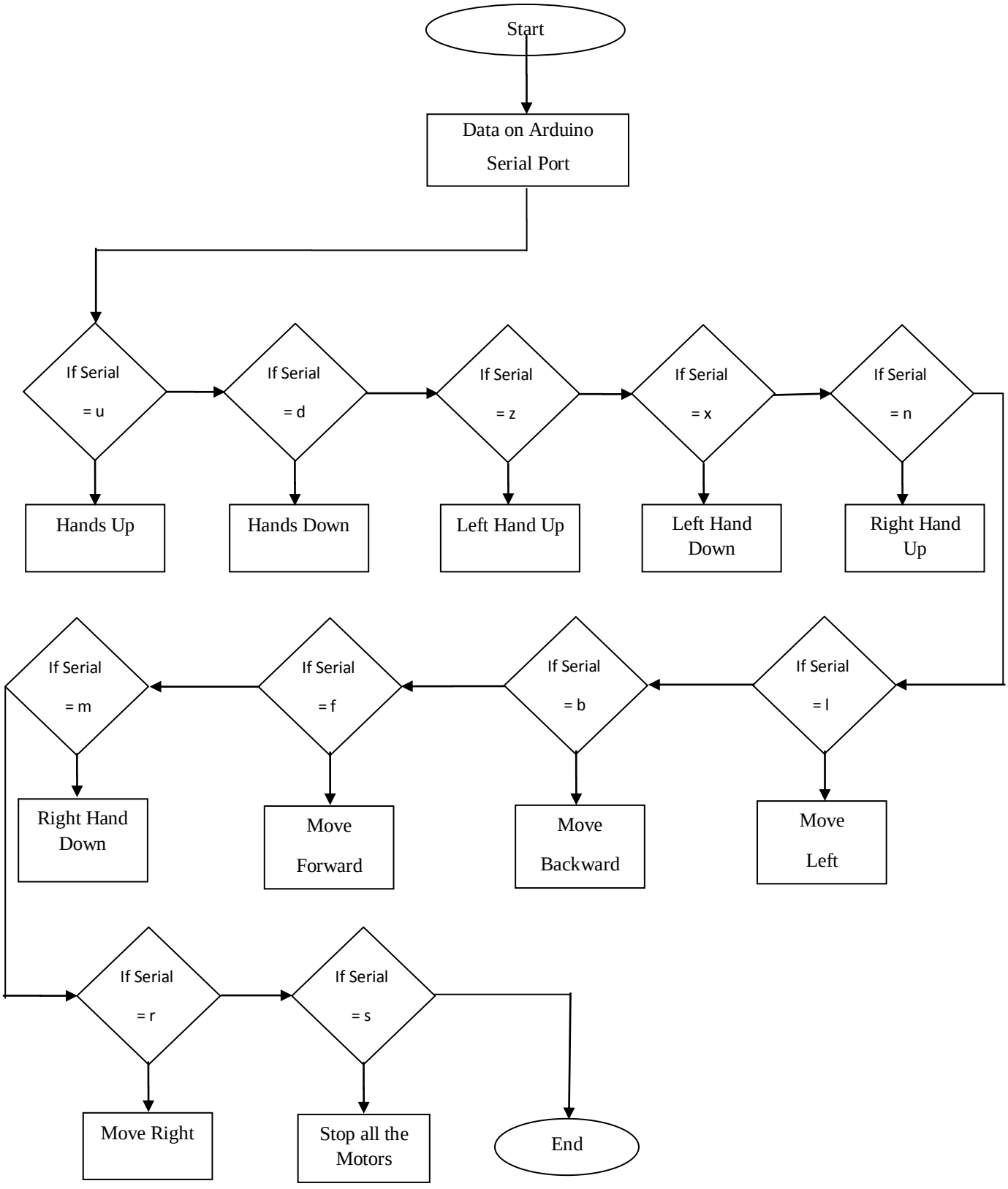

Fig-3.2: Flow Chart for Movement of the Robot

4. SYSTEM DESIGN

The Design of the Smart Robotic Assistant (Flappy) can be divided into fourparts: -

4.1. Android Tablet(Brain of the robot),

4.2. Control Unit (contains Arduino MEGA controller boards, driver for motors and LED matrix),

4.3. Robot's Upper Body,

4.4. Robotic Base.

4.1. Android Tab

An android tab with 3G calling functionalityhas been used as a brain of the robot which can recognizing the voice commands by using STT (speech to text recognition) and can also read text using TTS (text to speech recognition)it's also provides a GUI interface to the user for easilyinteracting and controlling the robot. The android app for the robot has been developed by using MIT app inventor tool which is a web-based android app development platform. The android tab also has some inbuiltsensors and connectivity options like- Compass, Proximity sensor, Accelerometer, Ambient light sensor, Gyroscope, Barometer, Temperature sensor, GPS, GSM, Wi-Fi,&Bluetooth.Which increases functionality ofthe robot.

4.2. Control Unit

In this robot we have used an Arduino MEGA board as the main control unit of the robots which generates all the control signals for the motor controllers, led matrix and for all the other output devices according to the sensors data, user commandsand programwritten to its flash memory (sized 256KB), the required power for all the sensors and I/O devices taken from the 12V, 7.5Ah battery which can powerup the robot up to 3.5 hours to 4.5 hours nearly.

4.3. Robot's Upper Body

The upper body of the robot consist speakers with amplifier module, servo motors, hand assembly, LED matrix with drivers & Ultrasonic sensors. The whole body of the robot is made using plastic Box and PVC pipes so the robot become light weightedand cost effectivedue to this the robot also become user-friendly. according to it.Table no.1 shows all the predefined commands for the base movements: -.

Input Voice Command	**Data on Arduino Serial Port**	**Movement**		**Hand Movement Direction**
		Motor A (Right Side)	**Motor B (Left Side)**	
Hands Up	U	Anti-Clockwise	Clockwise	Upward
Hands Down	D	Clockwise	Anti-Clockwise	Downward
Left Hand Up	Z	Stop	Clockwise	Left Hand Upward
Left Hand Down	X	Stop	Anti-Clockwise	Left Hand Downward
Right Hand Up	N	Anti-Clockwise	Stop	Right Hand Upward

Right Hand down	M	Clockwise	Stop	Right Hand Downward
Stop (all)	S	Stop	Stop	Stop

Table-1.Upper body DC Motor Rotation

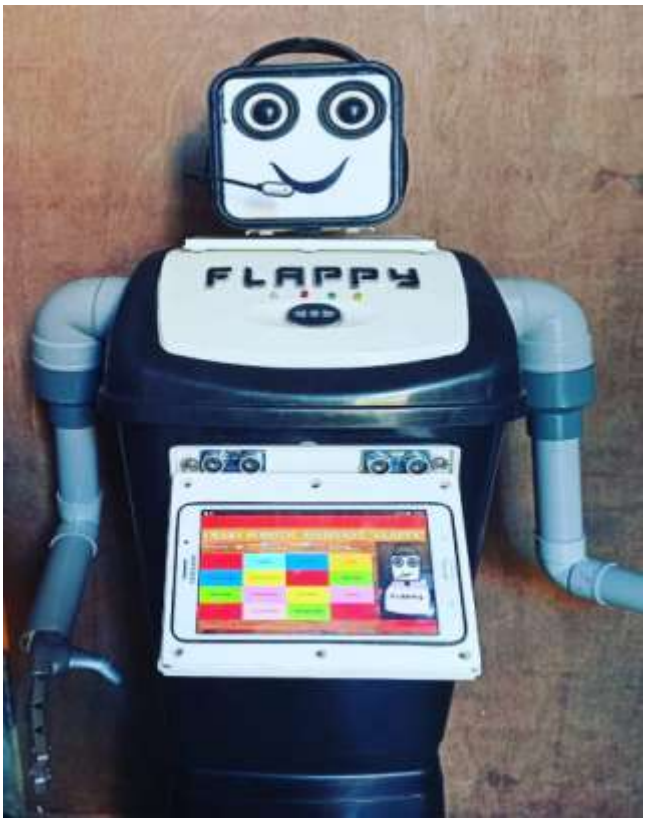

Fig.4.3: Upper Body of the Robot

4.4. Robotic Base

For controlling DC motors, H-Bridge(L-298N) Motor Driversare used.All the control signals forMotor driver aregenerated from the Arduino MEGA boardaccording to pre-defined functions written into its flash memory.Whenever any voice command input is received then the robot moves accordingly. Table no.2 shows all the predefined commands for the base movements: -

Input Voice Command	**Data on Arduino Serial Port**	**Movement**		**Robot Movement Direction**
		Motor C (Right Side)	**Motor D (Left Side)**	
Forward	F	Clockwise	Anti-Clockwise	Forward
Backward	B	Anti-Clockwise	Clockwise	Backward
Left	L	Anti-Clockwise	Anti-Clockwise	Left
Right	R	Clockwise	Clockwise	Right
Stop (all)	S	Stop	Stop	Stop

Table-2. Base assembly DC Motor Rotation

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Fig-4.4:Base assembly of the robot (bottom side)

5. BLOCK DIAGRAM

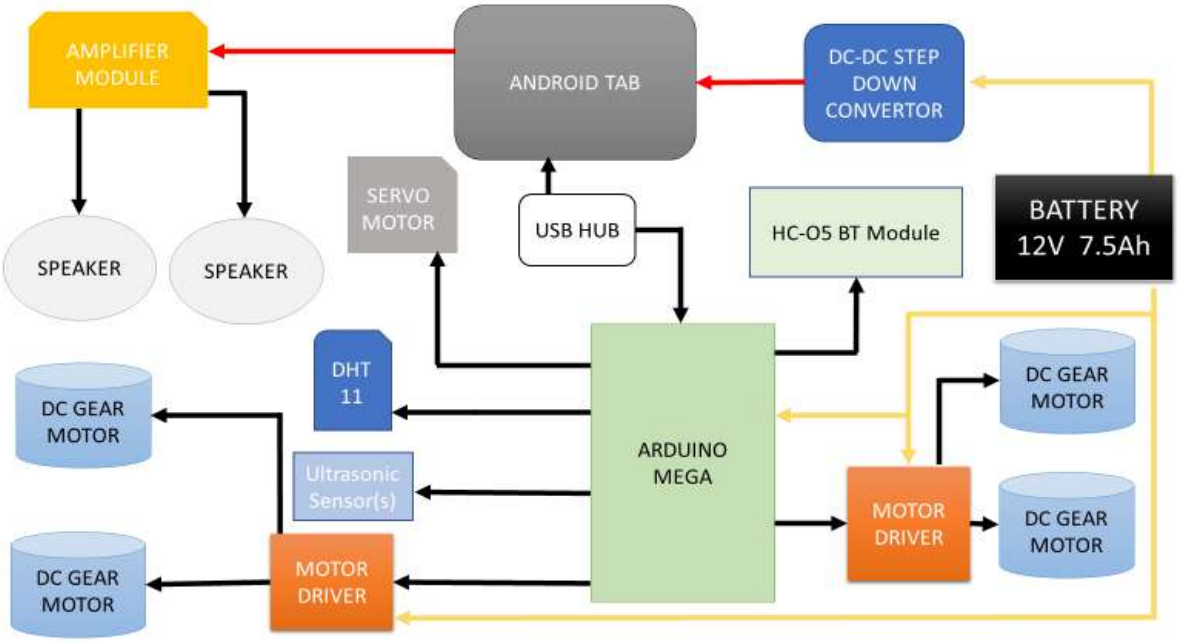

Fig-5: Block Diagram of SRA

International Journal of Advance Research in Science and Engineering
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6. CIRCUIT DIAGRAM

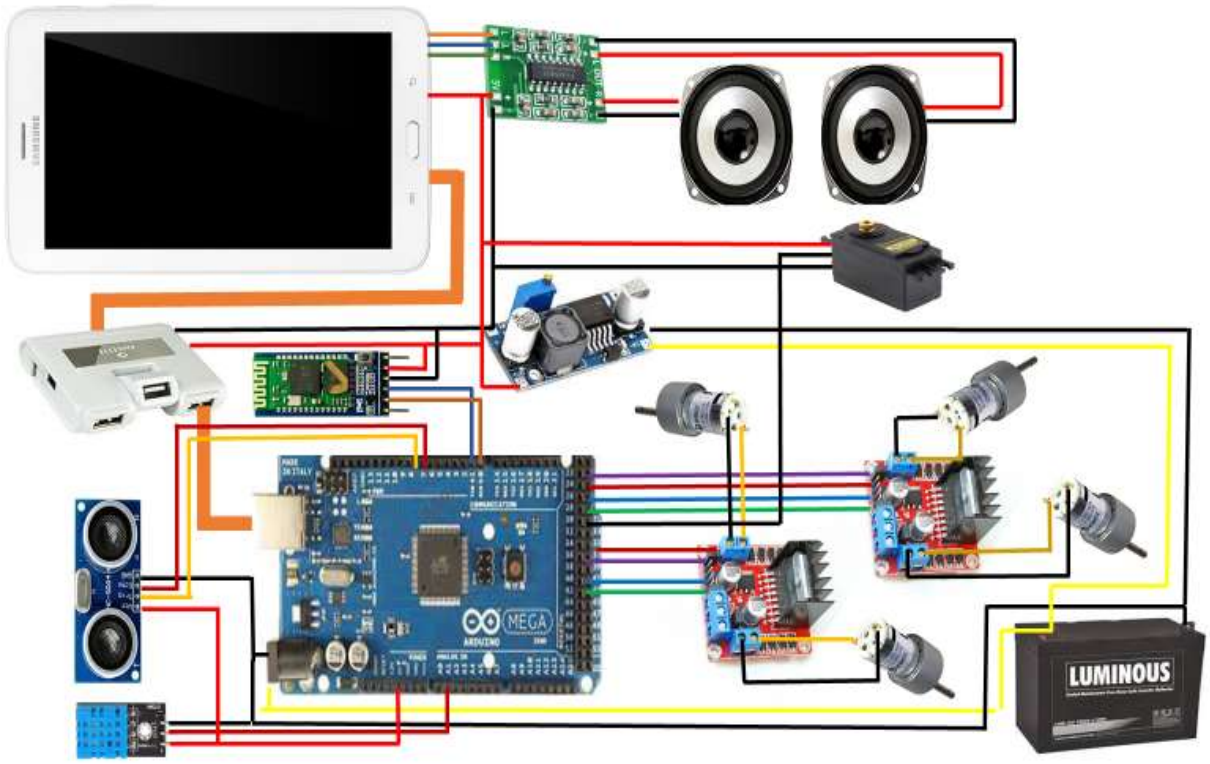

Fig-6: Circuit diagram of the Robot (Flappy)

7. RESULTS

The working and construction of the Smart Robotic Assistant is discussed above. After constructing the robot, it is shown in Fig-1. that can be controlled smoothly via voice commands, remote device or using its GUI interface screen. The query(tells the time and date, search the results on web, send email and message, call any person who is in your contact list etc.) section of the robot working well. The range of the robot depends according to control type for voice commands it's near is about 9m(30ft) for GUI interface we need to stay in touch with the robot and with internet connectivity the robot can be controlled from anywhere the only things we required is a good connectivity. The robot can move in all the direction after finding the instruction (Forward, Backward, Left, Right, Hand Up, Hand down etc.) also some other predefined functions and tasks.
Output of our robot has shown in the below figures: -

International Journal of Advance Research in Science and Engineering
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ISSN 2319 - 8354

7.1. GUI Functions ofFlappy: -

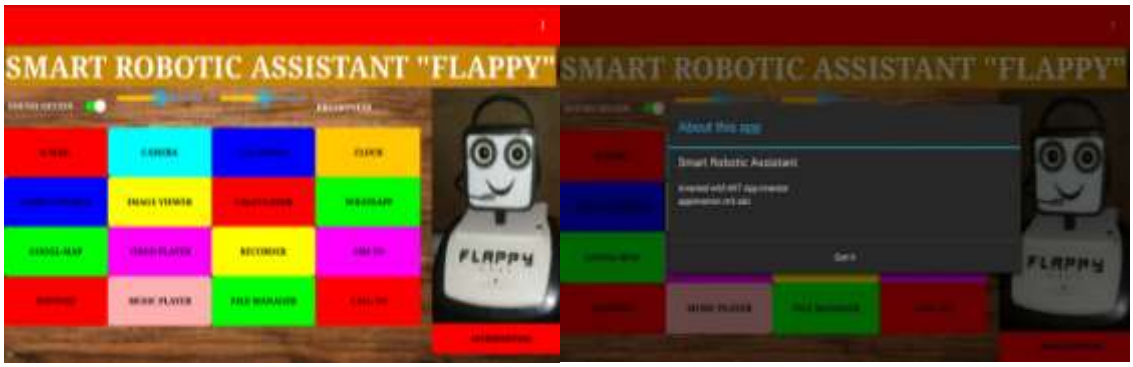

Fig-7.1: GUI Screen of FlappyFig-7.2: about GUI of FLAPPY

7.2. Mail test

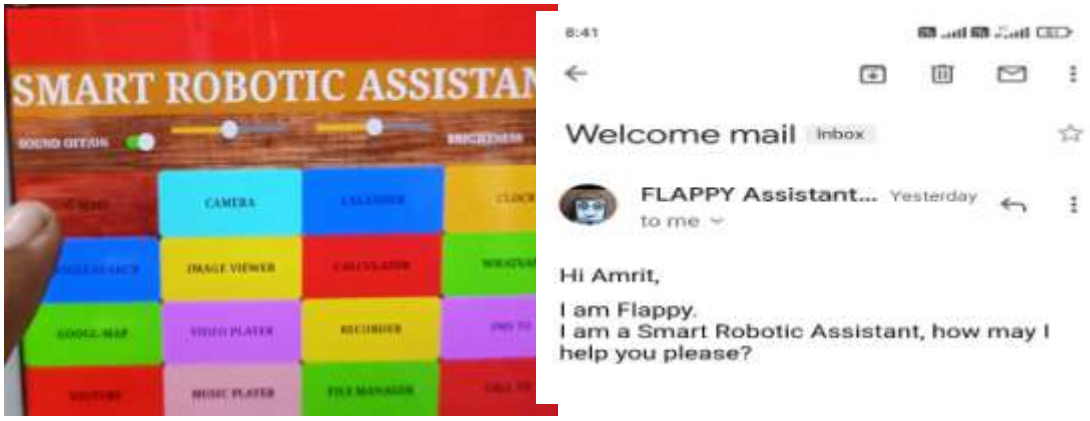

Fig-7.2.1: User send the mail toFLAPPY. Fig-7.2.2: FLAPPY mail received on mobile.

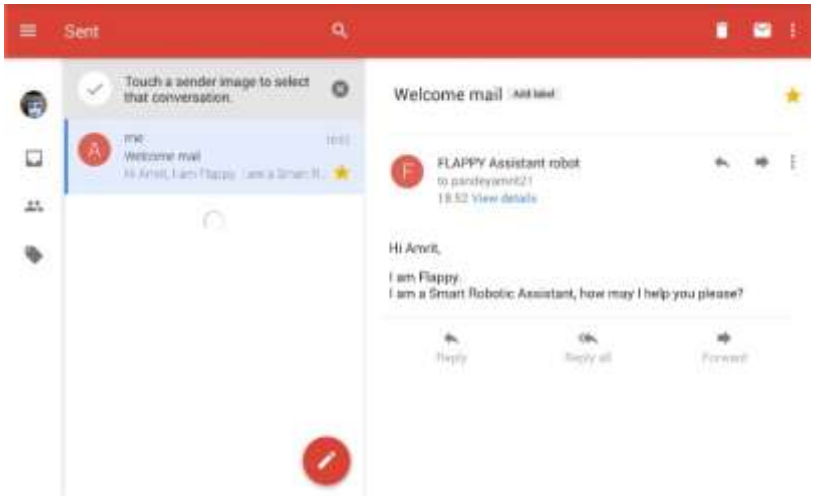

Fig-7.2.3: FLAPPYis sending a welcome mail

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7.3.Camera Test

Fig-7.3.1: User open the camera app Fig-7.3.2: FLAPPY camera detecting objects.

7.4. Call Test

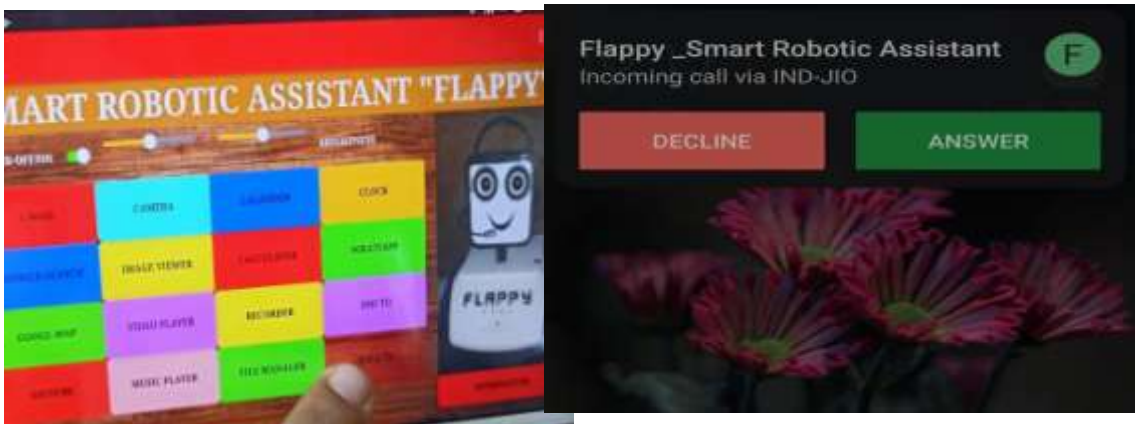

Fig-7.4.1: User is making a call to FLAPPYFig-7.4.2: Incoming call from SRA FLAPPY

7.5.Text messages test

Fig-7.5.1: User is sending the SMS to FLAPPY Fig-7.5.2: SMS chat with FLAPPY on user's mobile

Fig-7.6: SmartRoboticAssistant (FLAPPY)

8. ADVANTAGES

8.1 Easy to use and operate.

8.2 Can be operated easaly using voice commands.

8.3 Very useful for patients and physically challenged people.

8.4 It is very light weighted and user friendly so it doesn't pose a danger to children.

9. APPLICATIONS

9.1 Medical- for monitoring or helping patients & physically challenged people.

9.2 Education- in libraries, laboratory, educating students and researchers about various fields like robotics.

9.3 Industry- for guiding workers and monitoring the working of machines.

9.4 Entertainment- In theaters, malls, shops, as educational toys.

9.5 Social works- helping and guiding people and providing information's.

10. FUTURE WORK

10.1 The robot base assembly can be upgraded for better movement of robot on rough surfaces.

10.2 Functionality and precision of operation can be further improved using high quality components.

11. CONCLUSION

In this research paper we have present about the designing and construction of a smart robotic assistant which can be controlled by using voice commands or remotely using any laptop or pc with internet connection the robot also have a specific GUI interface to interact with it. This robot also has some automatic functions which

are pre-programed into its brain. For more functionality and automation purpose machine learning can also be used, it can help minimize energy consumption. Using the IoT connectivity, we can monitor and access our smart home easily from anywhere, which will be proved to be energy efficient. This type of robot is very helpful for the old age and physically impaired person and for working in some situations where the condition is not very well suited for humans as well as for helping people. For future work we would like to upgrade its control unit and the brain of our robot so that it can be more functional, smart and intelligent. After constructing the robotic assistant can be used for potential applications inside homes, hospitals and in industries.

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