AUTONOMOUS AND SELF CONTROLLED LIFE SAVING BOT

LIFE SAVING DEVICE REDUCING HUMAN EFFORTS

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Abstract

Future is all about robots. Robots can perform any task which humans cannot. With the advances in technology over the years, it is possible to remotely monitor areas of importance by using robots in place of humans. The drones which have been previously developed are confined to the region of surveillance and hence find their applications in limited areas. Moreover these drones do not meticulously present the data to us. Such drones are specifically designed for monitoring situations aerially. Thus these drones bear a protagonist part of mere surveillance. Nothing is more precious than human life. There are lots of sudden natural calamities like earthquakes, floods, storms etc., and manmade disasters like robberies, industrial and transportation accidents and one of the most threatening is the terrorist attack. These disasters produce a devastating effect and they see no difference between humans and material. Hence, many times humans are buried among the debris and it becomes impossible to detect them. A timely rescue can only save the people who are buried and wounded. Detection by rescue teams becomes time consuming and more difficult. Therefore, we propose a robotic vehicle that moves in the disaster prone area and helps in identifying the people who are alive both by manual and automatic methods.

Index Terms–Arduino, Raspberry Pi, Telegram Application, Camera**,** BO Motor.

INTRODUCTION

Nowadays the cities are growing faster and most of the people move into the cities which creates an enumerate increase in population. This high population increase, causes any disaster natural or manmade, into much more drastic accident. Indeed, the disasters may destroy many huge infrastructures causing complexity and hazardous disaster sites, which alters the reliability and effectiveness of the rescue teams. The complex and hazardous nature of these accidental sites links a great threat and risk to the rescue workers and hostages trapped in the disaster. These disasters induce disruption in the social and economic balance of the society. Hence, in this paper, a new approach for detecting humans using specific set of sensors, Raspberry Pi, Telegram and Arduino Microcontroller is proposed.

Detecting the presence of humans can be done by different techniques. In this proposed technology, we use a specific set of reliable sensors to detect the alive human body and a wireless mini camera to capture the live scene of the surrounding environment continuously. The main aim of this paper is to design a wireless robot that can be operated in automatic and manual mode. In manual mode the robot navigates around the areas, and finds humans in need of help. In manual mode, the robot is controlled by the Controller wirelessly by using an application, Telegram.

HARDWARE COMPOSITION

The system uses Raspberry pi 3 b+, Arduino Mega, BO Motors, L293D ICs, Camera, Submersible water pump, Fire Sensor, Ultrasonic Sensor.

SOFTWARE AND PROGRAMMING USED

Linux
Python
Arduino IDE
Embedded C/C++

Methodology

BOT Side

The designed system works in 2 modes, Autonomous and Manual. In the Autonomous mode, Robot moves by itself, searches for any living human and on finding, it stops and captures the image of the person and sends it to the Mobile of the user along with the images of the surroundings. The BOT also records the surrounding voices and regularly sends it to the user so that any human voice present may be identified and necessary steps are taken. In the Manual Mode, Robot is controlled by the Mobile by using a Telegram App that wirelessly controls the Robot by text and

voice instructions and moves it in left, right, forward and backward direction. In this mode, camera sends the real time video and images of the surroundings on the phone of the Controller and he can then move and stop the BOT as desired. The Controller can also communicate with the person, if found, to know about his needs and problem he is in.

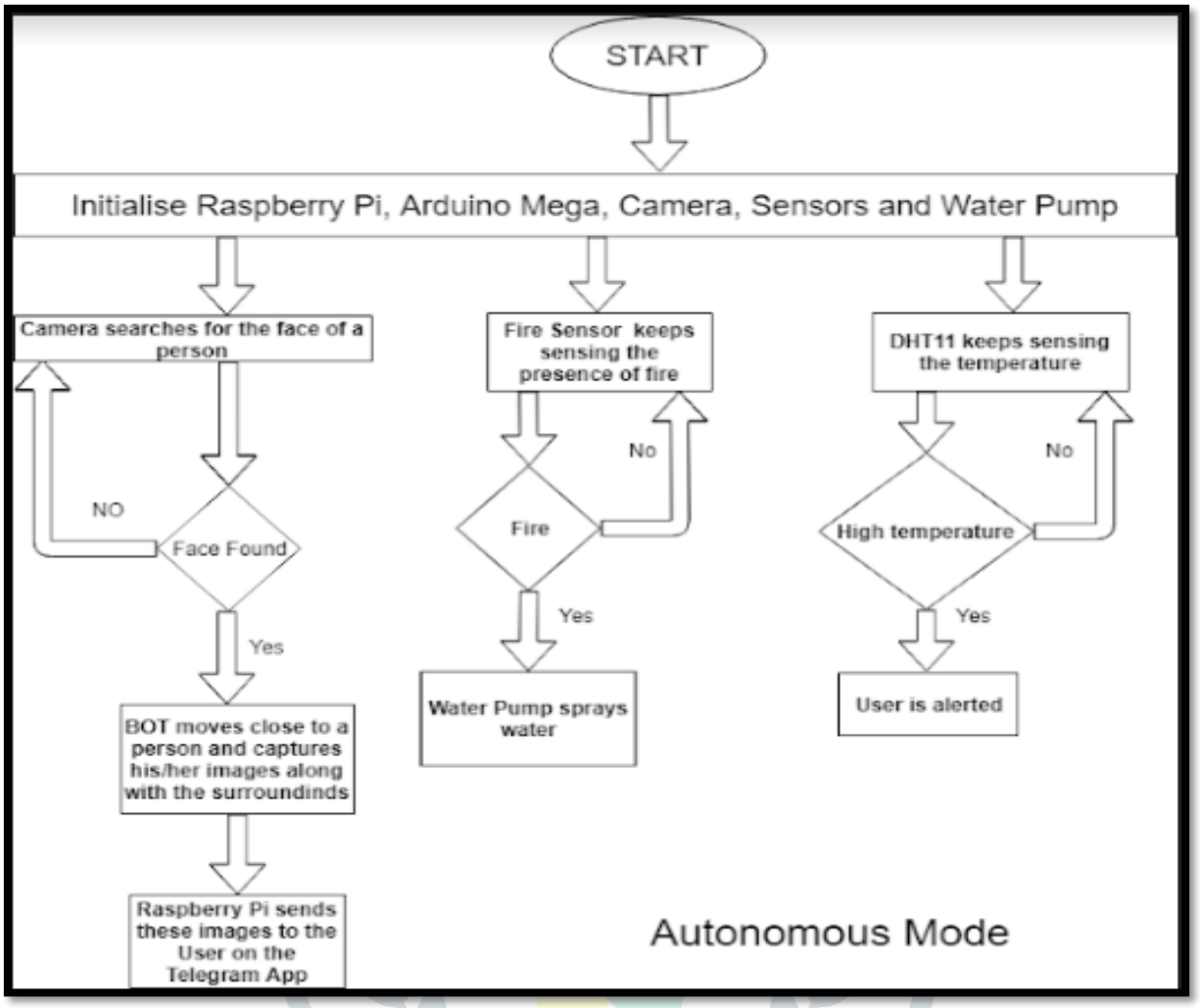


FIGURE I: Flowcharts of Autonomous Mode

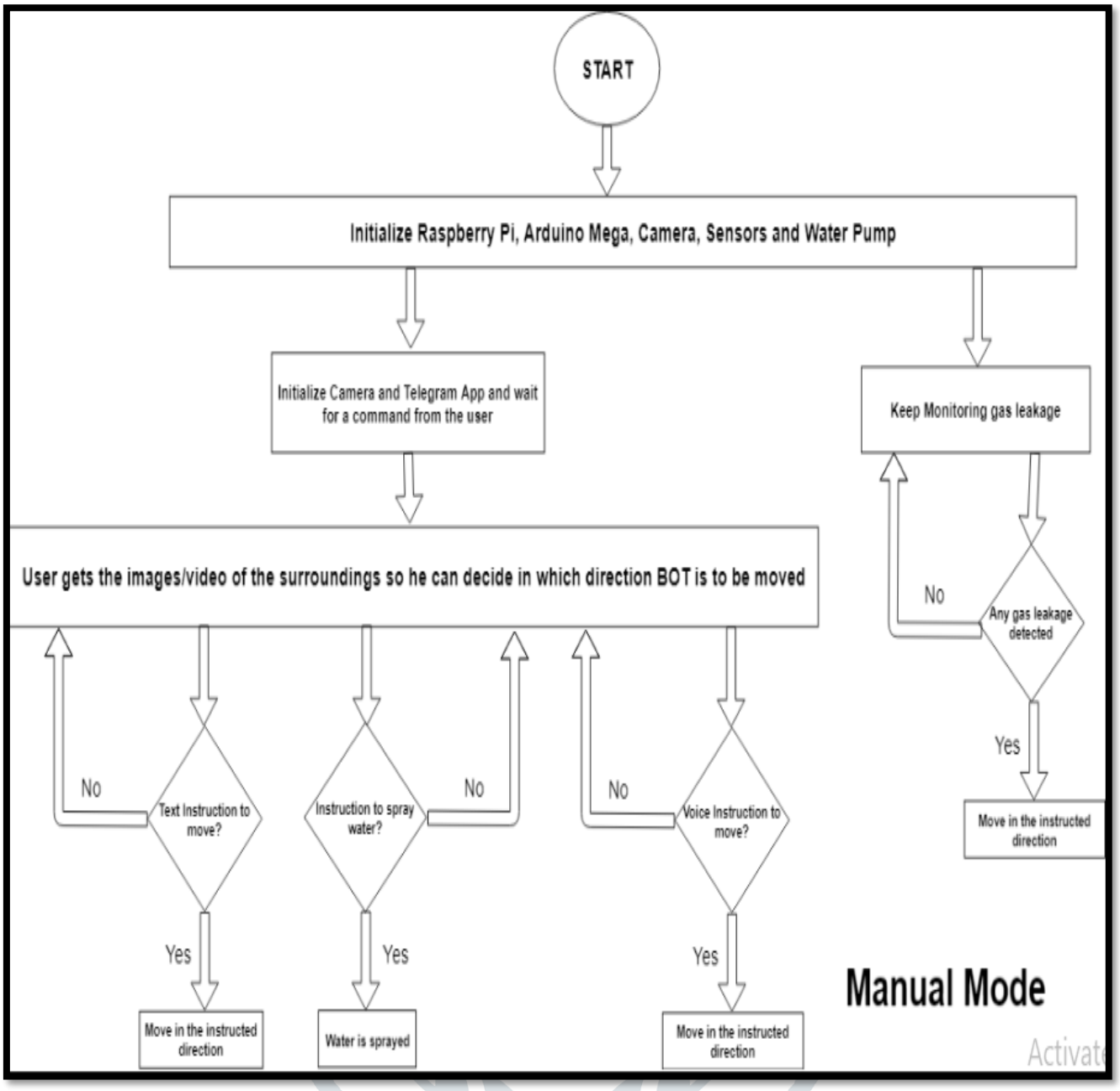


FIGURE II: Flowcharts of Manual Mode

Manual Mode

I. Raspberry pi 3 Model b+

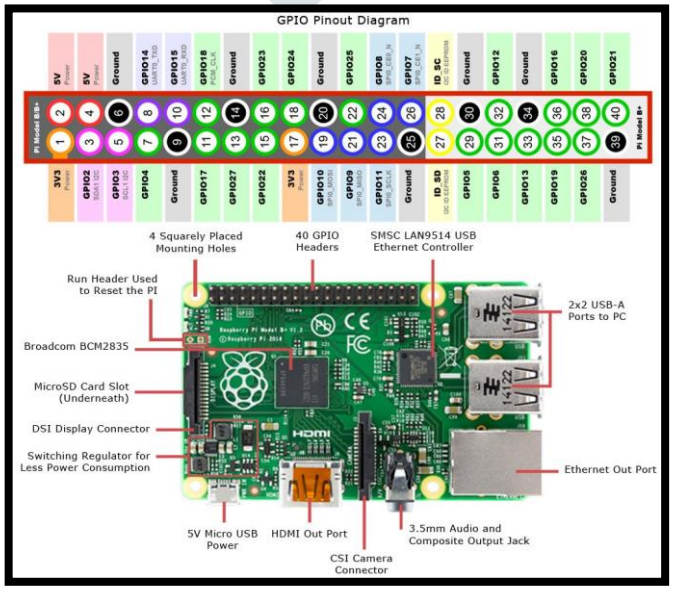


FIGURE III: Raspberry pi 3 Model b+

The Raspberry Pi 3 Model b+ is the third generation Raspberry Pi. This powerful credit-card sized single board computer and can be used for many applications. It has wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs. It has inbuilt Wi-Fi and the Robot when turned on, gets connected to the nearest Wi-Fi hotspot present. On the other hand, the phone of the Controller is also connected to internet and by using an application named Telegram, the robot and Controller's phone are connected. The camera is connected to raspberry Pi and it captures videos/images and then transmits it to the phone of the Controller through Wi-Fi. When the Controller finds a person in the video/image, he can then take the appropriate steps to rescue that person. The Controller can use both text and voice commands to control the BOT. Commands like 'Left', 'Right', 'Back', 'Front' and 'Stop' are used to move the BOT.

II. Raspberry pi camera

The Raspberry Pi Camera v2 is a high quality 8 megapixel Sony IMX219 image sensor custom designed add-on board for Raspberry Pi, featuring a fixed focus lens. It is capable of 3280 x 2464 pixel static images and also supports 1080p30, 720p60 and 640x480p 60/90 video. It attaches to Pi by way of one of the small sockets on the board upper surface and uses the dedicated CSi interface, designed especially for interfacing to cameras. The board itself is tiny, at around 25mm x 23mm x 9mm. It also weighs just over 3g, making it perfect for mobile or other applications where size and weight are important. It connects to Raspberry Pi by way of a short ribbon cable. The high quality Sony IMX219 image sensor itself has a native resolution of 8 megapixel, and has a fixed focus lens on-board. In terms of still images, the camera is capable of 3280 x 2464 pixel static images, and also supports 1080p30, 720p60 and 640x480p90 video.

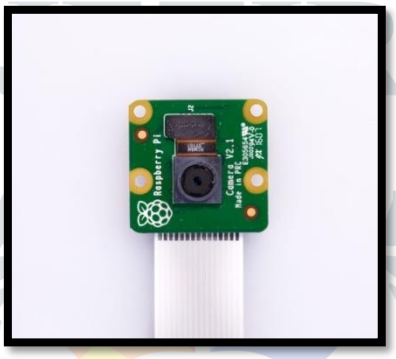
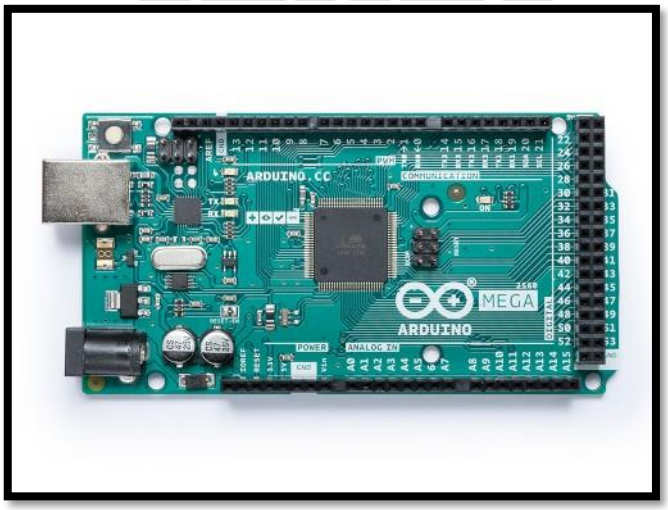


FIGURE IV: Raspberry pi camera

The camera is connected to Raspberry Pi and the video/image captured in real time is regularly transmitted to the Controller's phone using WI-FI. The camera is mounted on Servo motor that rotates it 360 degrees slowly so that the Controller gets the complete idea of the surroundings and moves the BOT in the desired direction.

III. Arduino Mega

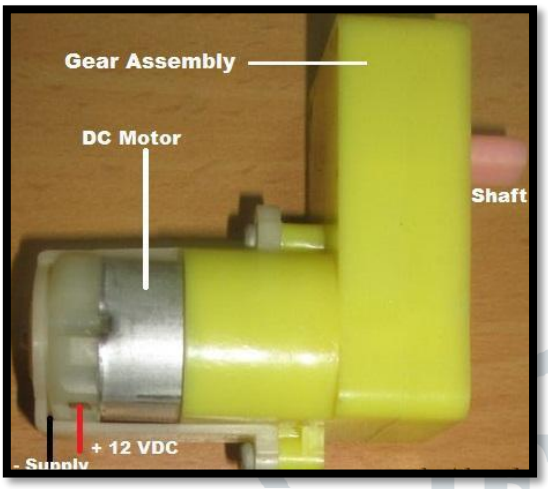


FIGUREV: Arduino Mega 2650

The Arduino Mega 2560 is a microcontroller board based on the ATmega2560. It has 54 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, four UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. In our project, all the four motors used in tyres, Submersible water pump, Fire sensor, Temperature Sensor, Gas Sensor and Raspberry pi are connected to Arduino Mega. On receiving the command from the Controller,

Raspberry Pi decodes it. The received command can either be to move the BOT or to capture images/video. In the former case, the decoded command is further sent to Arduino Mega that makes the BOT move in the commanded direction and in the latter case, Raspberry Pi commands the Camera to capture the images/video and transmits the captured image/video back to the Controller who receives it on the Telegram Application. Arduino Mega is connected to Motors (wheels) through motor driving IC, L293D. Two L293D ICs are used for 4 motors as one L293D supports two motors. Arduino Mega also commands the water pump to spray the water in case there is a fire alert.

IV. BO Motor



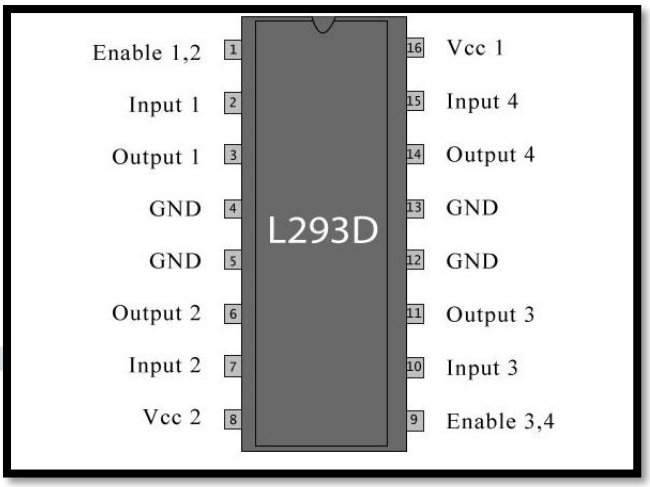


FIGURE VI: BO Motor **FIGURE VII: L293D IC**

DC motor (BO) Battery Operation. Dc motor converts electrical energy into mechanical energy. In any DC motor, RPM and Torque is inversely proportional. In all DC gear motor PWM Pulse Width modulation circuit is used. For driving DC motors, motor driving IC L293D is used. L293D is a dual H-bridge motor driver integrated circuit (IC). Motor drivers act as current amplifiers since they take a low-current control signal and provide a higher-current signal. This higher current signal is used to drive the motors. L293D contains two inbuilt H-bridge driver circuits. In its common mode of operation, two DC motors can be driven simultaneously, both in forward and reverse direction. The motor operations of two motors can be controlled by input logic at pins 2 & 7 and 10 & 15. Input logic 00 or 11 will stop the corresponding motor. Logic 01 and 10 will rotate it in clockwise and anticlockwise directions, respectively. Enable pins 1 and 9 (corresponding to the two motors) must be high for motors to start operating. When an enable input is high, the associated driver gets enabled. As a result, the outputs become active and work in phase with their inputs. Similarly, when the enable input is low, that driver is disabled, and their outputs are off and in the high-impedance state.

In our project, the direction of motors depends on the data received from the Controller. On receiving the forward command, Arduino directs the L293D to move all the motors clockwise. On receiving the backward command, Arduino directs the L293D to move all the motors anticlockwise. On receiving the left command, Arduino directs the L293D to move two left motors in anticlockwise direction and two right motors in the clockwise direction. On receiving the right command, Arduino directs the L293D to move two left motors in clockwise direction and two right motors in the anticlockwise direction.

V. Submersible water pump

The water pump is connected to Arduino Mega through n-channel MOSFET (IRF540n). A digital pin of Arduino is connected to the GATE of the MOSFET and when Arduino Mega senses fire, it sends a HIGH signalto the GATE of the MOSFET and water pump turns ON and water is sprayed on fire.

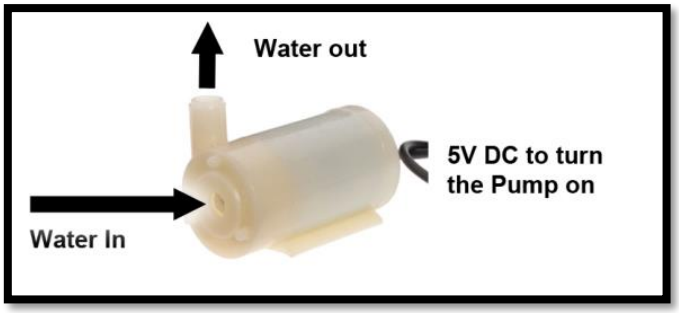


FIGURE VIII: Water Pump

VI. Fire Sensor

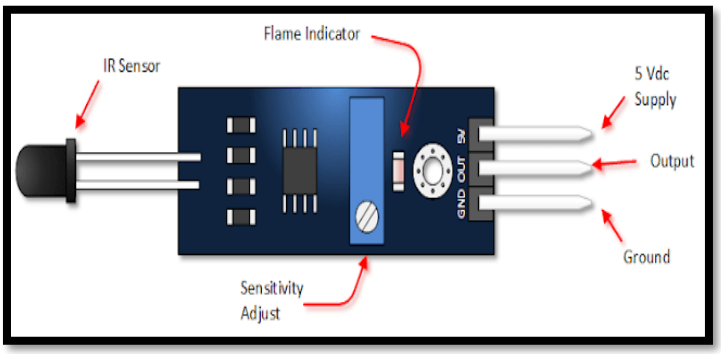


FIGURE IX: Fire Sensor

Fire sensor detects the presence of fire or flames. In extremely hazardous environments, flame sensors work to minimize the risks associated with fire. The flame sensor used here is nothing but a passive infrared sensor which is sensitive to only those optical wavelengths which are emitted from a flame. Once the flame light is detected the signal is amplified for further control and action circuitry

VII. Telegram App

Telegram Application is available in Play Store. The application is downloaded and installed on Controller's phone. In order to connect with the BOT side, an account of the BOT is created on Telegram App. The code uploaded on Raspberry Pi is such that the account created on Telegram represents the BOT and the Controller communicates with the BOT's Telegram account as if it is directly communicating with the BOT. When the Controller commands the BOT to move in any direction or to capture images/video, the BOT after completing the task sends the acknowledgement back to the Controller.

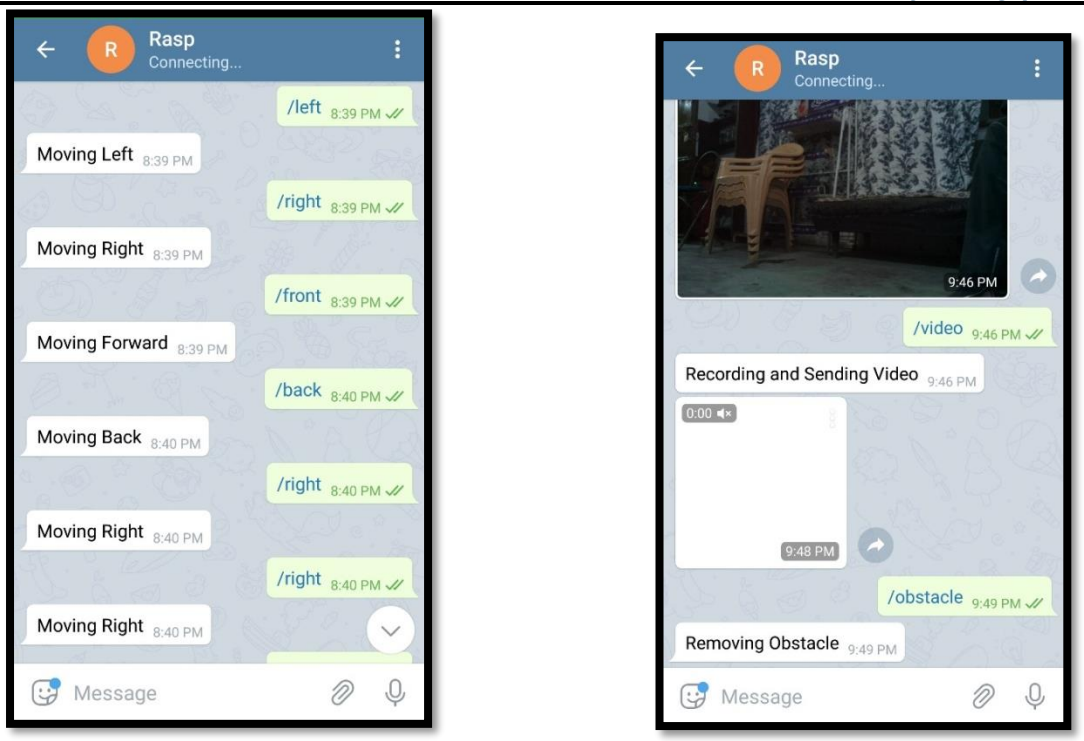


FIGURE XII: Images showing Communication between Controller and BOT using Telegram App.

Autonomous Mode

In this mode, the BOT works autonomously. The camera mounted on the servo motor starts rotating and searches for the human face or any motion in the surrounding area. Raspberry Pi processes this data and the angle and direction of the detected face or motion is sent to Arduino and Arduino directs the motors to move in that direction. Raspberry Pi directs the Camera to capture images and videos and sends them to the Controller in order to alert him. In this mode, Arduino keeps monitoring the temperature of the surroundings and the Controller is also alerted in case of fire.

CONCLUSION

Our innovation is an important device alternative to drone, offering a small land based surveillance BOT capable of being controlled by an android device using Telegram application. It has such features that make it suited for a number of applications like real time monitoring of surroundings by capturing images and videos and sending them to the Controller, fire extinguishing. fire sensing, etc. There is still room for improvement in the design and fabrication of our innovation for it to able to be used in more applications. The aim of this project is to reduce the efforts and risks that humans face when it is required to access various unsafe and unknown areas like caves, fire places etc. We have developed a BOT which can go into the unsafe and unfavorable areas and perform checks on the surrounding environment.

FIGURE XIII: Prototype of BOT Side

REFERENCES

[1] Rui Jiang, Xin& Ming Lv, Yi & Han Cheng, Xiao. (2014). Design of Wireless Communication System Based on nRF24L01. Advanced Materials Research. 945-949. 1756-1759. 10.4028/www.scientific.net/AMR.945-949.1756.

[2] Syed, Muslim &Hashmani, Manzoor& Syed Sajjad Hussain, Rizvi &Vali, Uddin &Rehman, Mobashar. (2019). Automatic Image Annotation for Small and Ad hoc Intelligent Applications using Raspberry Pi. MATEC Web of Conferences. 255. 01003. 10.1051/matecconf/201925501003.

[3] SURYA, ERWIN & KURNIA NINGSIH, YULI. (2019). Smart Monitoring System Using Raspberry-Pi and Smartphone. ELKOMIKA: JurnalTeknikEnergiElektrik, Teknik Telekomunikasi, &TeknikElektronika. 7. 72. 10.26760/elkomika.v7i1.72.

[4] Hassan, Aslinda& Bing Sheng, Siah& Md. Shah, Wahidah& Bahaman, Nazrulazhar. (2018). An Automated Irrigation System Using Arduino Microcontroller.

[5] Alkharabsheh, A.R.A.. (2018). An intelligent cooperative multi-agents based parking system: Design and implementation. Journal of Theoretical and Applied Information Technology. 96. 2804-2815.