INTRODUCTION OF SMART TASH-NAER IN KASHMIRI CULTURE

AMALMAGATE TRADITION WITH TECHNOLOGY

TAHIR SHOWKAT BAZAZ
Junior Engineer, BSNL India
Srinagar, J&K

Abstract

Kashmir, the paradise on earth located in the lap of Himalayas is world famous for its serene and breathtaking scenery. Apart from the mesmerizing places, Kashmir is a treasure trove for handicrafts, culture and tradition that is handled down from the past. Among all the traditions lies the beautifully carved copperware Tash-Naer. Tash-Naer is used widely in Kashmir during marriages and family functions. Every traditional meal begins with washing of hands as the Tash-Naer (basin with jug) is passed among the guests. The pair consists of a huge copper jug filled with water called a "Naer" and a pot with handle called "Tash" in which water gets collected. The host carries the water filled Naer and handy basin Tash from place to place resulting in the biggest disadvantage of a traditional Tash-Naer as it requires large amount of physical exertion. The Smart Tash-Naer however not only combines the Kashmiri tradition with growing technology but also overcomes the problem present in a traditional one.

Index Terms **–** Tash-Naer, Arduino, Raspberry Pi, Image Processing, Face Detection, Wireless**,** Alkaline water filter.

INTRODUCTION

Culture shows the social behavior and standards found in human societies. Kashmir, the distinct part of world is characterized by its unique, eccentric and multifarious cultural blend along with the snow caped glittery mountains, calm green surrounding and beautiful lakes. One of the important cultural identities of Kashmir is the famous multi course meal Wazwaan served mostly during weddings and functions. This traditional meal begins with washing hands as Tash-Naer (copper jug with basin) is passed among the guests. Tash-Naer is a handy basin consisting of a copper jug and a basin with handle. Copper material is beautifully carved to form various items such as Tash (basin),Naer(jug), Traem(plate)etc. owned by every Kashmiri household. The proposed system is the innovation of a traditional Tash-Naer intending to reduce man power and make the system more efficient. This smart system will replace the simple Tash-Naer pair with a bot having both basin for cleaning hands and the in built tank. The purpose of the innovation was to design and develop a system that can reduce manpower, time efficient hand wash and also gives the same traditional taste of Kashmiri Culture. For the implementation of this system both hardware and software was used.

HARDWARE COMPOSITION

The system uses raspberry pi 3 b+, Arduino Mega, Arduino nano, DC Motors, L293D ICs, Camera, Buttons, nRF24L01, Submersible water pumps, Water level sensor, IR Sensor, alkaline water filter.

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, Tash-Naer moves by itself, recognizes a person and stops, when a person puts his hand in front of tap, water comes out and then Tash-Naer again moves forward searching for the next person **Syed, Muslim & Hashmani, Manzoor & Syed Sajjad Hussain, Rizvi & Vali, Uddin & Rehman, Mobashar. (2019) [2]**. In the Manual Mode, Tash-Naer is controlled by a self-made remote that wirelessly controls the Tash-Naer and moves it in left, right, forward and backward direction. In this mode,

camera mounted on Servo Motor sends the real time video on the phone of the controller and he can then move and stop the Tash-Naer as desired. In both these modes, water purification and mp3 player are common. Water is stored in the tank and once it is used by people for washing their hands, it is automatically purified and sent back to the tank. This process repeats 3 times and after that the Tash-Naer notifies the controller to change the water. MP3 player helps in instructing people how and when to put their hands in front of Tash-Naer. It also plays the Kashmiri Music in background.

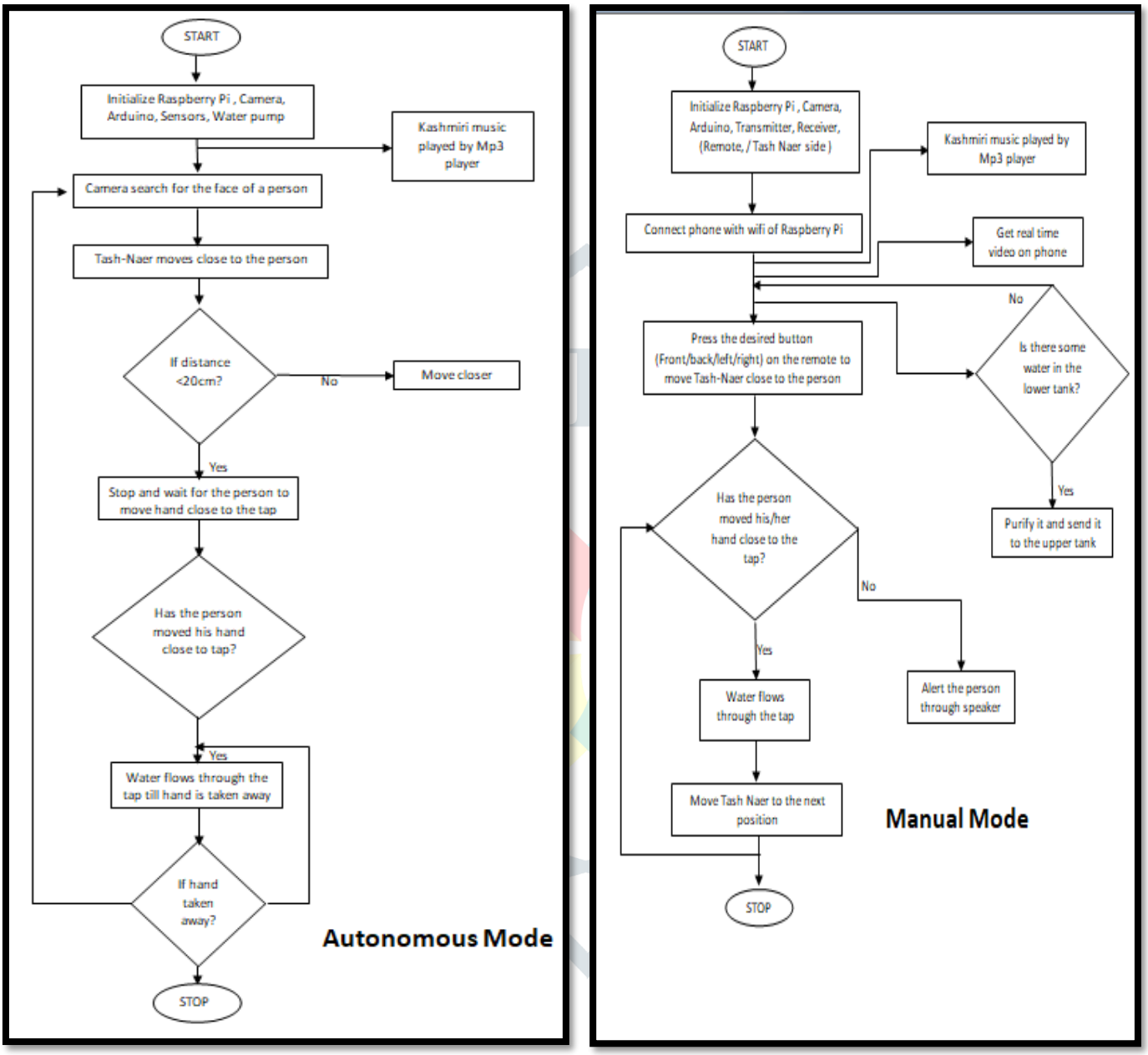

FIGURE I: Flowcharts of Autonomous and Manual Mode

Manual Mode

I. Raspberry pi 3 Model b+

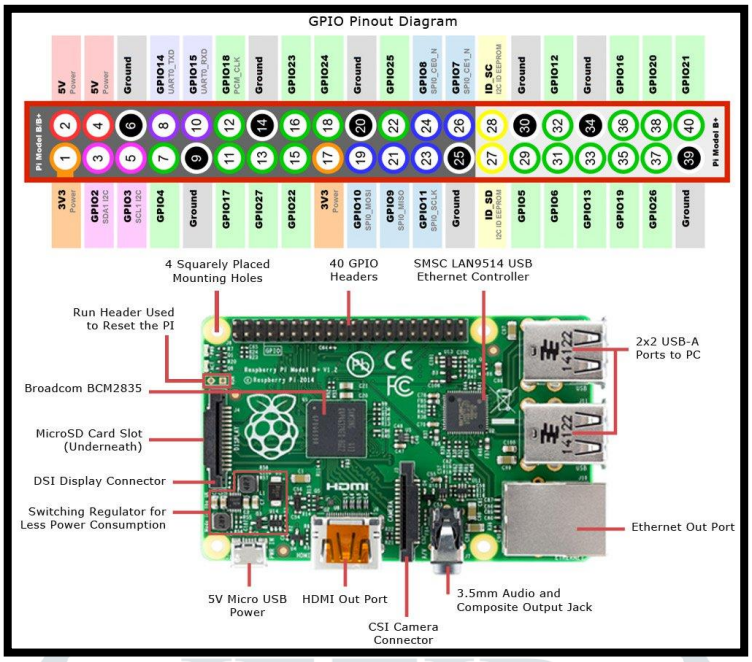

FIGURE II: Raspberry pi 3 Model b+

The Raspberry Pi 3 Model b+ is the third generation Raspberry Pi. This powerful credit-card sized single board computer can be used for many applications. It has wireless LAN & Bluetooth connectivity making it the ideal solution for powerful connected designs. Raspberry Pi 3 Model B has an inbuilt wifi. When the project is turned ON, the phone of the controller gets connected to the wifi of the Raspberry pi **(SURYA, ERWIN & KURNIA NINGSIH, YULI. (2019)) [3]**. The camera connected to raspberry Pi captures videos and then transmits it to the phone of the controller through the wifi. When the controller finds a person in the video captured on the phone, he stops the Tash-Naer and after then moves it again.

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's 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 **Syed, Muslim & Hashmani, Manzoor & Syed Sajjad Hussain, Rizvi & Vali, Uddin & Rehman, Mobashar. (2019) [2]**. 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.

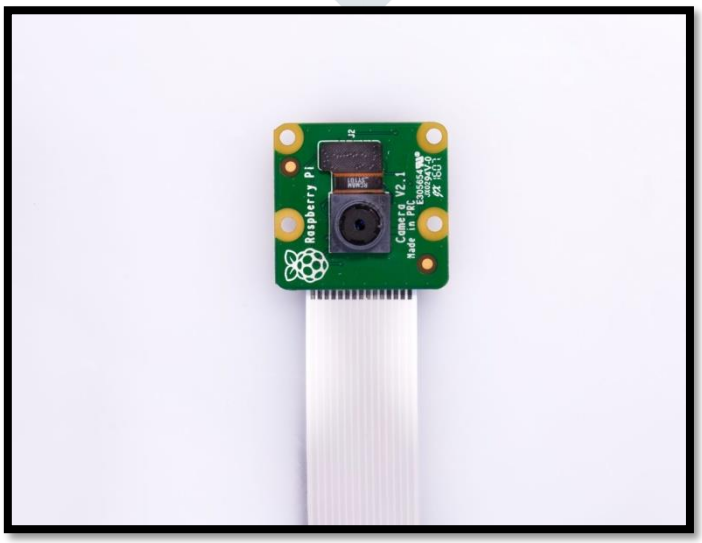

FIGURE III: Raspberry pi camera

The camera is connected to Raspberry Pi and the video recorded in real time is regularly transmitted to the controllers phone using wifi. The camera is mounted on Servo motor that rotates it 360 degrees slowly back and forth so that the controller gets the complete idea of the surroundings and moves the Tash-Naer in the direction desired.

III. Arduino Mega

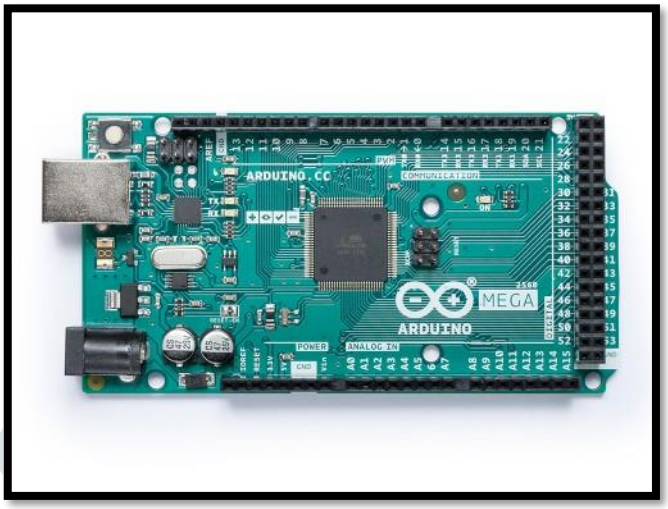

FIGURE IV: Arduino Mega 2650

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. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. In our project, all the four motors used in tyres, submersible water pumps, Receiver (nRF), Water level sensor and IR sensor is connected to Arduino Mega. On receiving the command from transmitter, the receiver (nRF) sends it to Arduino mega. Arduino processes it and depending on the data received, it takes the required decision, e.g., moves forward when such data is received. 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. Mega also keeps monitoring the lower tank water level by water level sensor and when water is found, it is pumped by submersible water pump to alkaline purifier for cleaning and then to the upper tank for further use. IR sensor and another submersible water pump are also connected to Arduino Mega, when a person puts his/her hand in front of IR sensor, high signal goes to Mega, which in turns signals the submersible water pump in the upper tank to pump the water into the tap. As long as the person keeps his/her hand in front of the sensor, water keeps flowing through the tap.

IV. BO Motor

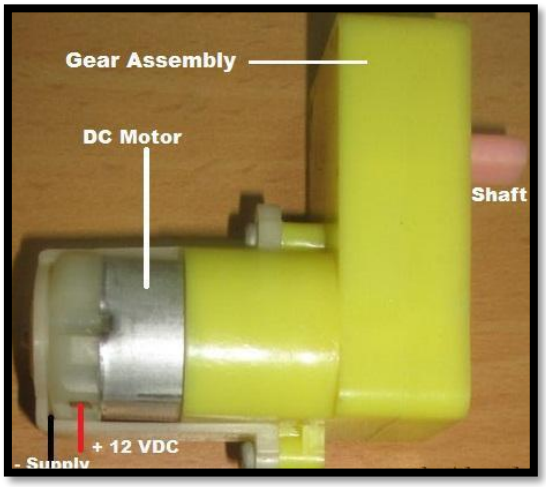

FIGURE V: BO Motor

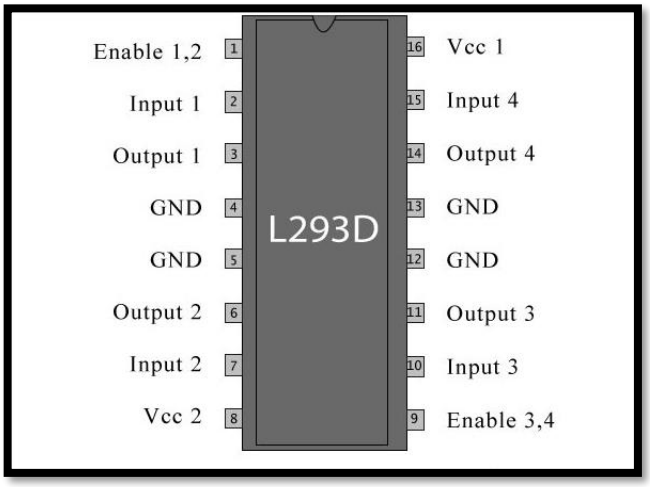

FIGURE VI: L293D IC

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 remote. 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

We are using two submersible water pumps in our project. One in the upper container and other in the lower tank. Each pump is connected to Arduino through n-channel MOSFET (IRF540n). A digital pin of Arduino is connected to the GATE of MOSFET and when Arduino signal a HIGH voltage at the GATE, water pump gets ON **(Hassan, Aslinda & Bing Sheng, Siah & Md. Shah, Wahidah & Bahaman, Nazrulazhar. (2018**)) **[4]** . When a person puts his hand in front of IR sensor, a HIGH signal goes to Arduino and Arduino send a signal to the gate of the MOSFET to ON the water pump. The water pump in the upper tank gets ON by IR Sensor and the water pump in the lower tank gets ON when water starts to gather in the lower tank and the pump sends it to purifier i.e, back to the upper tank.

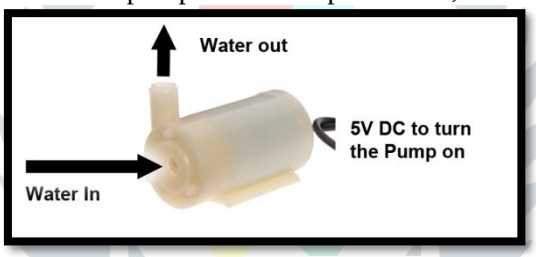

FIGURE VII: Water Pump

VI. nRF24L01

FIGURE VIII: nRF24L01

The nRF24L01+ transceiver module is designed to operate in 2.4 GHz worldwide ISM frequency band and uses GFSK modulation for data transmission. The data transfer rate can be one of 250kbps, 1Mbps and 2Mbps. The operating voltage of the module is from 1.9 to 3.6V**.** The module supports programmable output power viz. 0 dBm, -6 dBm, -12 dBm or -18 dBm and consumes unbelievably around 12 mA during transmission at 0 dBm, which is even lower than a single LED. And best of all, it consumes 26 µA in standby mode and 900 nA at power down mode. The nRF24L01+ transceiver module communicates over a 4-pin Serial Peripheral Interface (SPI) with a maximum data rate of 10Mbps. All the parameters such as frequency channel (125 selectable channels), output power (0 dBm, -6 dBm, -12 dBm or -18 dBm), and data rate (250kbps, 1Mbps, or 2Mbps) can be configured through SPI interface. The SPI bus uses a concept of a Master and Slave, in most common applications our Arduino is the Master and the nRF24L01+ transceiver module is the Slave **(Rui Jiang, Xin & Ming Lv, Yi & Han Cheng, Xiao. (2014)) [1]**. In our project, two nRFs are used. One on the remote side (transmitter side), other on the Tash-Naer side (receiver side). There are 6 buttons on remote side. Each for left ,right, forward, back, stop and emergency water. On pressing a specific button on the remote, arduino sends data to the nRF for wireless transmission. The nRF on the Tash-Naer side receives the data and sends it to Arduino for further processing.

VII. IR Sensor

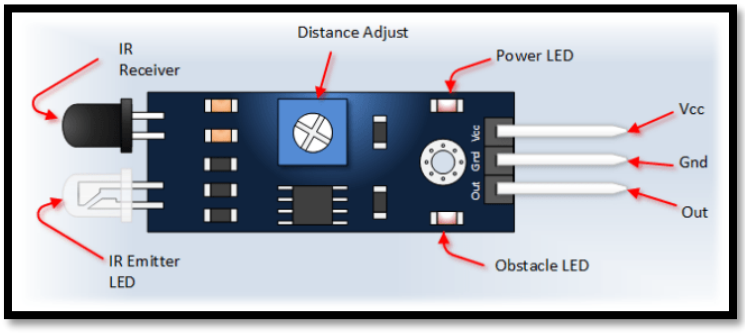

FIGURE IX: L293D IC IR Sensor

An infrared sensor is an electronic instrument that is used to sense certain characteristics of its surroundings. It does this by either emitting or detecting infrared radiation. An infrared light emitting diode (IR LED) emits light of Infrared range 700 nanometers (nm) to 1 mm. This light is not visible by naked eyes but can be seen by a camera (that is why these are also used in night vision cameras).A photo diode gives response in term of change in resistance when light falls on it. That change is measured in terms of voltage. An IR LED and a Photo diode are used in a combination for proximity and color detection. An IR LED (transmitter) emits IR light, that light gets reflected by the object, the reflected light is received by an IR receiver (Photo Diode). Amount of reflection and reception varies with the distance. In our project, IR sensor is used to detect the hand. When hand is placed in front of it, Arduino sends a signal to water pump of upper tank to pump water through the tap.

VIII. Water Level Sensor

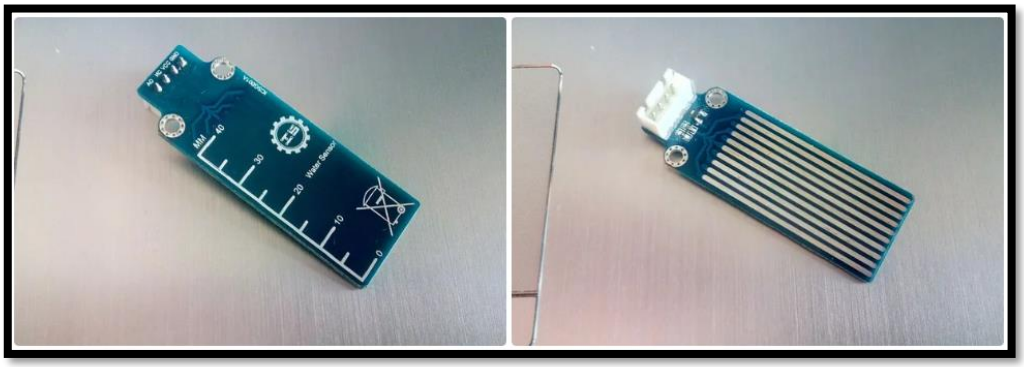

FIGURE X: Water Level Sensor

Water level sensor is used to measure water level in water tank or in any other equipment. When a person washes his hand, water goes into the lower tank. Water level sensor is used in the lower tank to detect the presence of water. When water is detected, Arduino sends the signal to water pump present in the lower tank to pump the water back into the upper tank through the purifier.

Remote Side

Remote side consists of Arduino nano, buttons and nRF, voltage regulators.

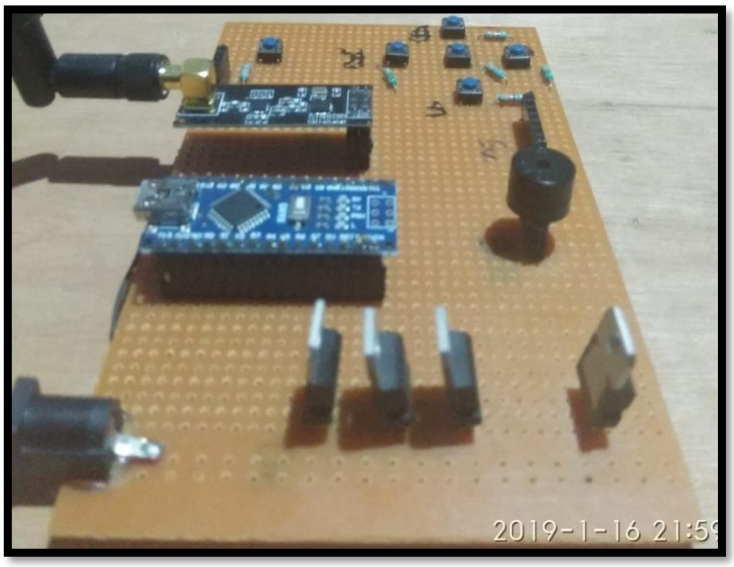

FIGURE XI: Self Made Remote

Arduino nano keeps on monitoring the state of the buttons. Six buttons are connected to 6 digital pins of arduino. On pressing a specific button, corresponding digital pin of Arduino nano goes HIGH. Arduino then sends data to nRF that acts as wireless transmitter and transmits data to the Tash-Naer side.

Autonomous Mode

In this mode, there is no use of remote side end. The remote end (Tash-Naer) works autonomously. The camera mounted on the servo motor starts rotation and searches for the human faces present. Raspberry Pi processes this data and selects the closest face among all the faces detected by the camera **(Syed, Muslim & Hashmani, Manzoor & Syed Sajjad Hussain, Rizvi & Vali, Uddin & Rehman, Mobashar. (2019)) [2]**. The angle and direction of that particular face is sent to Arduino and Arduino directs the motors to move in that direction. On moving towards the person, Arduino keeps on monitoring the distance between the Tash-Naer and the person. When the distance remains less than 20cm, Tash-Naer stops and waits for the person to put his hand near the IR Sensor and water is released. The water gets collected in the lower tank and Water level sensor starts measuring the water level. The water pump in the lower tank then pumps the water back to the upper tank through the alkaline purifier. When the person moves his hand away from the sensor after washing his hand, Camera again starts capturing the faces and Tash-Naer again moves towards the closest face. During all these processes, MP3 player keeps on playing the traditional Kashmiri music.

CONCLUSION

The following conclusions were drawn from the present innovation.

1. With the incorporation of Smart Tash-Naer in Kashmiri culture, man power can be reduced significantly.
2. Smart Tash-Naer can prove time efficient as well as cost efficient.
3. Same water is used repeatedly, so it is water efficient.

Smart Tash-Naer can prove handy in functions and causes no effect or harm to the basic culture of Kashmir.

FIGURE XII: Prototype of Bot Side

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