

Borderline Monitoring System of Surveillance Tank Using Android

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Abstract—Since decades, it is witnessed that the border security is entirely based on the human factors (i.e), security and surveillance of the countries borderlines is conducted by military force and security agencies. Many innocent people killed daily due to horrible terrorist attacks at the borders. In spite of all measures taken by defense military force intruders still can cross the borders to destroy the important properties. In this case a full coverage of the borderline through police or military patrol requires a considerable number of patrols and support staff. Increasing the number of police or military patrols, supported mainly on human factor directly affects the risks of the life as well as the growth of the cost, so a full control of the borderline in this way is very troublesome. To solve this problem, we have designed a surveillance tank vehicle which can communicate with a smartphone. By using Wi-Fi this tank can be operated within a specific range and by sending different commands through a cell phone, instead of involving the risk for military force's. This tank can be used for spying at restricted areas, research, security, temperature measurement, metal detection, obstacles detection, and traffic control. The designed system features all the capabilities of controlling a system with a smartphone's single click. The motion of the tank can be controlled with an Android device and the tank can move in four different directions (i.e., forward, backward, turn left, and turn right). The tank is also equipped with a camera that provides a live video of surroundings on a cell phone screen so, the system has efficiency to receive the live video streaming in real time for this I.P Camera (Foscam F18918W) is used.

Index Terms: Surveillance system using PIC Micro-controller, Android, GUI, Sensors, Remote monitoring, Smartphone.

1. Introduction

Nowadays security issues are rapidly increasing at the state of countries borderline and the lives of human beings are in a great danger. Everywhere unpleasant events happen, and claims deaths of innocent people in form of target killing, snatching, robbery, and bomb blasts. Security agencies suffer from such kind of problems in order to maintain peace and security. They are not well equipped to tackle these kinds of situations, which makes it difficult for them to fight and save their own lives. Sensor technology is famous among the other technologies, which is mostly considered for border surveillance. But there are few challenges associated with this technology such as power supply for sensor nodes, difficulties in maintaining the sensors in case of a failure of any sensor node, and false alarms leads to problems in reliability [1],[2].

In object detection techniques, Background Modeling technique is used to detect the static as well as the moving objects in an image by changing the variations between the current and the reference background image. This background subtraction method has a simple algorithm; therefore, it is very sensitive due to continuously changing external environment [3].

Similarly, there are others methods like Temporal Difference methods used to calculate the absolute

differences between two consecutive images to extract moving regions and it can obtain a threshold function to determine changes. The Optical Flow method uses the optical flow distribution characteristics of moving objects over a time in an image sequence. In real time Flow computation methods cannot be applied for video streaming because they are complex and highly sensitive to noise [4],[5].

We have proposed a solution to this problem which can help and assist our agencies to deal and tackle in such kind of situations and will provide the safeguard to the people as well as for themselves. The system of automation of security monitoring using electronics assembly is enabling to develop a model device that can keep the monitor in real time [6]. The aim of our project is to design such a wireless monitoring vehicle. The designed system can be used for security, spying, and search purposes in the areas where human being have no access (i.e., under forest, desert, mountains, space, and dangerous areas). The projecting mechanism is based on a robotic tank structure which can be controlled through an

android device. The purpose of designing this type of mechanism clearly reflects the idea of a robot which can move in any direction and can be controlled through a wireless protocol (i.e., Wi-Fi) from any place within the specified range. As we are familiar that the Android system is based on Linux operating system and is an open source which was first used as an efficient mobile software [7]. This research focuses on the mobility, compatibility, and is more efficient than human. It has also the capability to provide on spot live video streaming of the surrounding, with an I.P camera mounted on it, with the help of a smartphone or a tablet all the controls are on one hand (i.e., designing the application on android technology). It provides an ease (no need to wire controls) to the user. The user can easily control the system from any far place [8], [9].

The basic aim of this project is to design such a system that can deal with the unpleasant situations efficiently and more accurately. This system has a complete package which makes it technologically improved and more efficient than any other human machinery. Especially This project can be used for military purposes, spying at the borderlines and control of no go areas.

PROPOSED SYSTEM:

Designing phase of this project includes the following parts that are:

2.1 Mechanical Structure:

We designed the robotic tank structure, which consists of chains on the both sides for the movement of tank. There are two D.C gear motors and are responsible for the motion of robot. Both motors can move the system in the respective direction (i.e., forward, reverse, left, and right).

Secondly, we designed a stabilized spying camera platform, which is responsible for the live streaming of surrounding.

The platform has two degree of freedom (DOF), so the camera moves (left and right). With the help of a D.C gear motor.



Figure (1) Tank front view

The mechanical side, tank structure driving mechanism the system designed it first used rubber belts on both sides of the gear of robot. As the structure moves in any direction, belts slip off the surface and do not provide the actual movement of the robot as wanted. it forced to make slight change in design. Now instead of rubber belts chain was used which is satisfying our performance needs.

2.2 Electronic Structure:

In this system designing of all the electronic circuits on a PCB which includes micro-controller board and all other boards placed within the robotic structure. All of these are responsible for running the entire system. The system includes different types of modules and wireless devices including Wi-Fi module, router, and I.P camera. Furthermore, a smartphone which has all the features of controlling the overall mechanism from anywhere within specified range through an android application.

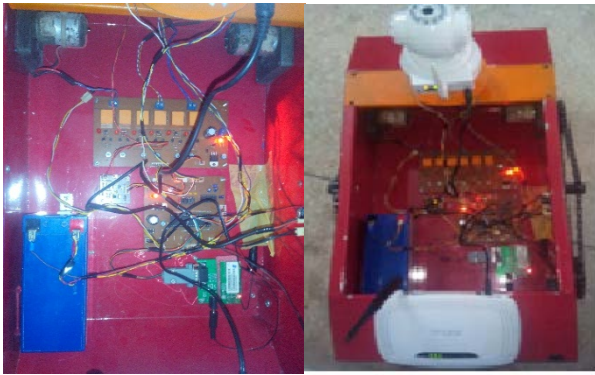
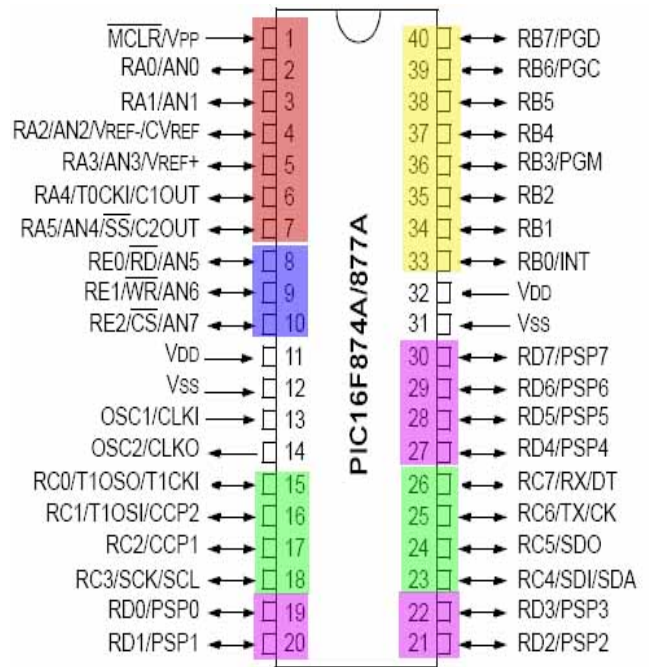


Figure (2) Electronic circuitry

2.3 PIC 16F877 Micro-controller:

PIC micro controller is the heart of this system which controls almost all the components used in this project. It controls all the motors used in the system. The command from the smart phone through Wi-Fi module is entertained and it is received by micro-controller at its serial port to perform a particular task it is also responsible for other different functions according to received command

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PIC 16F877 Micro-controller

2.4 I. P Camera (Foscam FI8918W):

A live video streaming should be added in the system's parameters. The system's surrounding video is transmitted on an android application. For this purpose, a I.P camera is used which will connect itself through a router and will start the video streaming.

The Foscam FI8918W wireless IP Camera features high quality video and audio, pan/tilt, remote internet viewing, motion detection, night-vision, and also used to develop network video recording system.

In addition, it is accessible on the internet by using a standard browser such as IE, Chrome, Firefox, Safari, and Bing etc. The camera can also be used for many other smart functions like, smartphone baby, elderly parent, and pet monitoring.



Figure (3) Ccamera

The stabilized platform of camera has some balancing issue due to the movement of the D.C motor used in it, it sometimes loses its stability & sometimes moves very fast but due to use of limit switches it tries to overcome the issue.

Methodology:

We designed a Surveillance Tank Vehicle which can communicate with a PC/Smartphone. Wireless communication will be done between the tank and PC/Smartphone by using a RF transceiver module by designing a suitable GUI (Graphical User Interface), system used PIC micro-controller (16F877, 40 pin IC), a Wi-Fi (TCP/IP module, Mo3, 14 pin IC), a few sensors such as (metal detector, temperature, and obstacles detector), a power supply (12V), a router (TP-link model), and a D.C gear motors.

Whenever, cell phone sends any command to the router then the router communicates with the Wi-Fi module. Module receives a command from the router at its antenna and sends it to the micro-controller at its serial port. Wi-Fi module is connected with microcontroller at its serial port and also it is connected to the router through IP Port. After receiving the command from the module, Micro-controller performs the desired task.

If "Forward" command is sent then the tank will move in the forward direction, on "Reverse" command, the tank moves in the reverse direction. If "stop" command is sent then the tank will stop its movement, similarly, on the turn left or turn right the cam moves in the left or in the right.

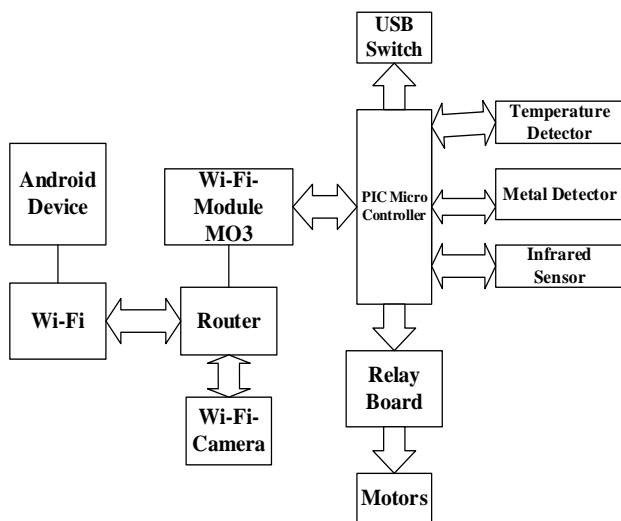


Figure (4) Block Diagram of System

b) Working Flow chart of the system:

A basic flow diagram to represent the Automation & Monitoring of Surveillance Tank is shown in Figure (5).

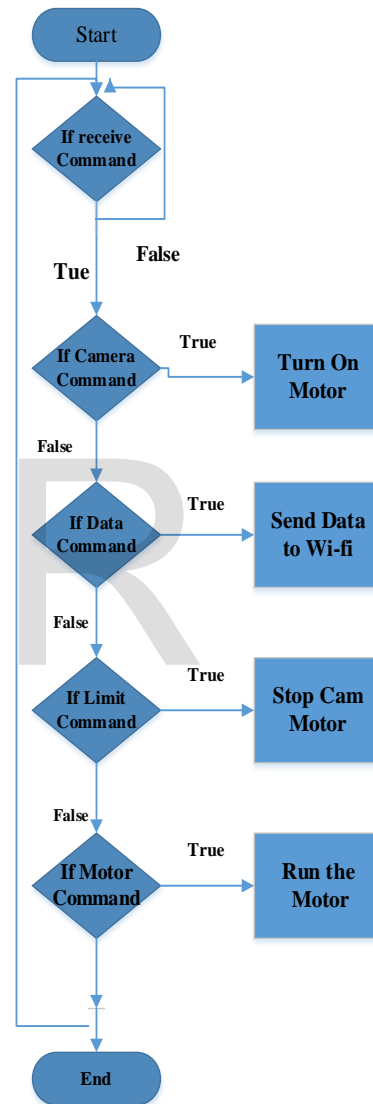


Figure (5) Working Flow Chart

Results and Discussion:

First, switch on the mobile phone and power up the tank. After power up it connect cell phone's Wi-Fi with the tank's Wi-Fi router, when they are connected with each

other than a wireless communication will take place between them. Our next goal is to start the application in a cell phone.

When the application is started initially it gives no result until the command is sent.

Results:

Temperature	Metal	Indication of Motion
4°C	Detected	Yes

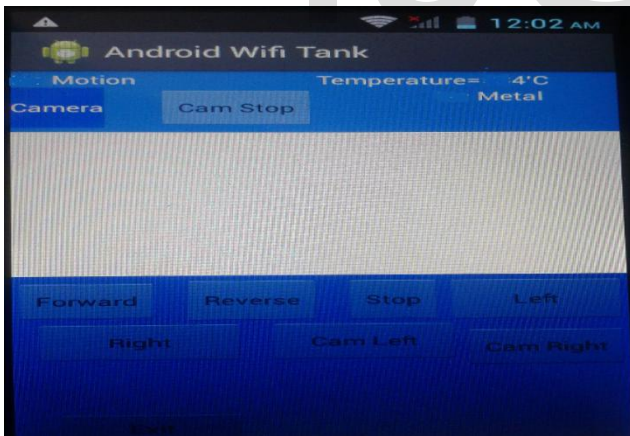


View of Application Software (1)

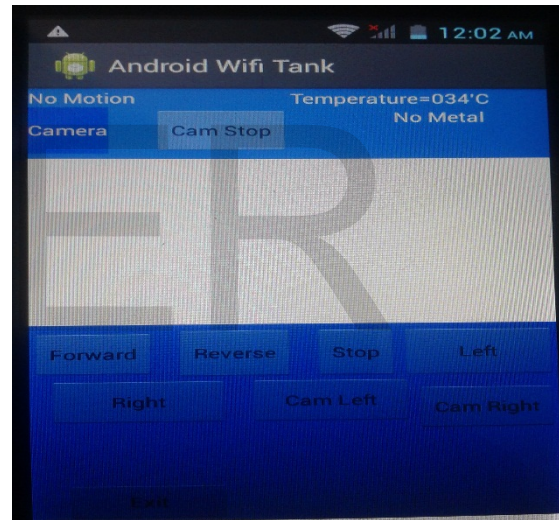
Once the system is started, it calculates the values according to the present environment, we have received the following data as shown in the figure below.

An indication of motion occurs when no object appears at its front.

In order to learn more about the system we again calculated some values by placing it in another environment, where there is an absence of metal, from the figure we can see some variation as compared to the previous results.



View of Application Software (2)



View of Application Software (3)



Figure (8) Surveillance Result

Results:

IP	192.168.0.5
Port	81
Angle	300-degree pan, 120-degree tilt

5. Acknowledgment:

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Conclusion and future works:

This purpose of this paper is to design a system that can be easily controlled from any place within a prescribed range. The system works on wireless protocol (Wi-Fi). The system consists of sensors, router and module to make our project more efficient and accurate. We design an Android based application so that the user can operate the whole system on their smart phone or tablet by just one click at screen of cell phone for many applications specially on borderline Surveillance security system.

In future, this article can be further improved, instead of using Wi-Fi module for the connectivity of tank from smart phone to controller, the GSM module can be used also gun mechanism for shooting a target manually can be added, furthermore the system can use image processing instead of manual operation of target shooting. After applying image processing (Face Recognition) the image first detected and then identify the terrorist or unknown finally we can lock that and shoot the target.

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