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Design and Implementation of Robotor: An Autonomous Surveying Vehicle using Microcontroller 2560

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ABSTRACT: This article summarizes an autonomous vehicle using firebird v robot for automatic surveillance and providing security for remote areas. Proposed robot doesn't require human being for control operation. This robot makes continuous locomotion around the area under observation and monitors the movements across the area. Fire Bird V gives exposure to the world of Robotics and embedded system. The Robotor is innovative and adoption in the software and hardware design. This robotor consist of Fire bird V robot interfaced with USB wireless camera and live video transmission reception is done on computer. TV tuner card is required to interface USB wireless camera receiver with computer.

KEYWORDS: Fire Bird V; USB wireless camera; TV Tuner, Proximity Sensor; White Line Sensor;

I. INTRODUCTION

Robotics is hodgepodge of electronics, mechanics, and software. Robotic research today is focused on developing systems that exhibit modularity, flexibility, a general and extensible software environment and connectivity to other machines. In this highly developing society time and man power are critical constrains for completion of task in large scales. The automation is playing important role to save human efforts in most of the regular and frequently carried works. One of the major and most commonly performed works is picking and placing of jobs from source to destination.

Now a day's industry is more and more turning towards computer-based automation mainly due to the need for increased yield and delivery of end products with uniform quality. The rigidity and generally high cost of hard-automation systems, which have been used for automated manufacturing tasks in the past, have led to a broad based interest in the use of mechanical arm proficient of performing a variety of manufacturing functions in a flexible environment and at lower costs. The use of Industrial mechanical arm characterizes some of modern trends in mechanization of the manufacturing procedure. Though, industrial mechanical arm also exhibit a monolithic mechanical arrangement and closed-system software structural design. They are concentrated on simple repetitive tasks, which tend not to require high exactitude.

The pick and place mechanical arm is a human controlled based system that detects the object, picks that object from source location and places at desired location. For detection of object, human detect presence of object and move machine accordingly.

II. RELATED WORK

In [1] authors used presents a study of the wide spread prevalence of lost limbs and sensing system which is major concern in present day due to accidents. To assist people paralyzed from waist down and impairments in hands as well as adults unable or very difficult to walk, the proposed voice actuated wheelchair model uses voice control for navigation in familiar environments. The voice of the person is detected by voice capture module and compared with predefined voices loaded in system. By storing a single letter in voice recognition kit for each direction control, the

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recognition time is reduced drastically and thus quick reach to destination is obtained. As per the voice, the system instructs to immediately move wheelchair with detected voice.

As interest in robotics continues to grow, robots are increasingly being integrated into everyday life. The results of this integration are end-users possessing less and less technical knowledge of the technology. For example, consider the application of mobile robots in the health care industry, where the intended end users are patients themselves. In this case, the need for simplified, reliable, and user-friendly robot designs is of almost importance. So this project reduces the mystery of robotics to average user [2].

The DTMF technology is associated with digital telephony and provides two selected O/P frequencies (One high band and one low band). The DTMF technique consist of 16 common alphanumeric characters (0-9, A-D, *, #) on the telephone. Each characters is uniquely referenced by selecting one of the four low band frequencies associated with the matrix rows, coupled with selecting one of the four high band frequencies associated with the matrix columns [1].

Where wl and wh are the low and high frequencies of the sine waves being used, A and B are the amplitude of the signals and φ is the initial phase shifts [6].

In the article the underwater research vehicle is controlled by a mobile (with 4G support) which makes a video call to the mobile phone (with 4G support) attached to the vehicle. In the course of a video call if any button is pressed a tone corresponding to the button pressed is heard at the other end of the call. This tone is called DTMF tone [2]. The vehicle perceives this DTMF tone with the help of phone stacked in the vehicle. The processing of received DTMF tone is done by microcontroller with the help of DTMF decoder. The decoder decodes the DTMF tone into its equivalent binary digit and this binary number us sent to the microcontroller. The microcontroller is pre-programmed to take a decision for any given input. Any mobile which makes a video call to the mobile phone stacked in the underwater research vehicle will acts as remote. So, this is a simple robotic project which even does not require the construction of receiver and transmitter kits, but has an innovated application of cell phone, 3G and robust control [2].

III. PROPOSED BLOCK DIAGRAM

Robotor consist of ATMEGA 2560 microcontroller as a heart of the system shown in fig. 1. Servo expansion is provided to connect the servo motors to microcontroller. 16x2 LCD display connected in 4 bit mode display variety of messages on screen. Locomotion and intern movement to base motors are provided by taking Analog IR proximity sensor reading in to the consideration. Sharp IR range sensors are detecting the distance of robotor from various objects. Since robotor is following white line, three white line sensors are placed at the bottom of robotor with four position encoders. Zigbee communication module is interface to send video signals to computer. ROM of microcontroller is programmed through RS232. Universal serial bus is required by Boot loader software to burn hex file in to controller.

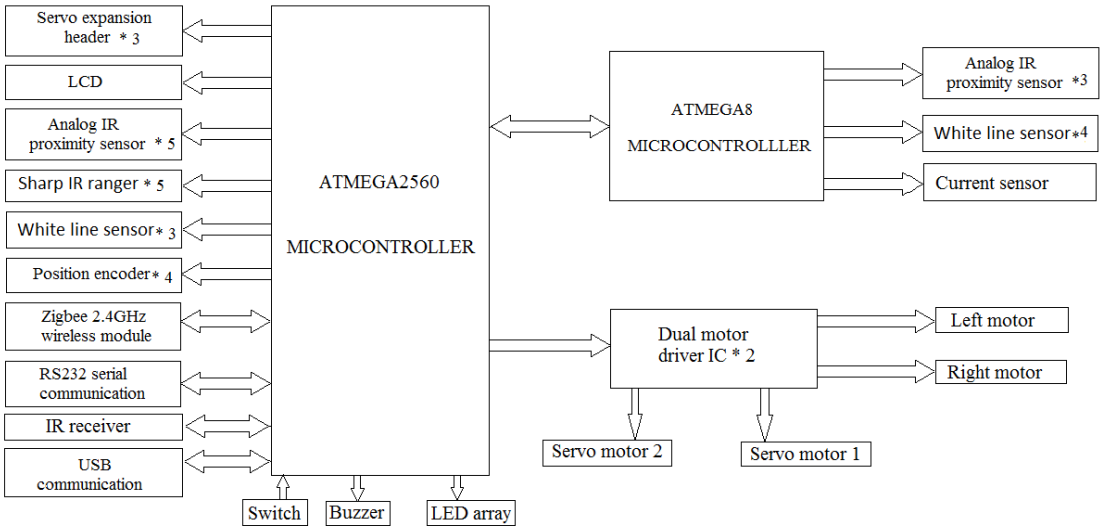

Fig.1. Block diagram of Robotor

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USB TV tuner card is used for acquiring image transmitted by the wireless camera shown in fig. 3 on the PC. After driver installation one can acquire video stream in TV Tuner card's GUI, Robot GUI Output of the wireless camera's receiver module is in the composite video format. In order to acquire the image it is required to set the input video format as composite video. Camera can be directly connected to TV Tuner card if it has composite video out connector. This is an optional accessory and will not come with all the cameras. Camera can be connected in wired mode for doing experiments for long duration of time or if we encounter any problem during warless image acquisition.

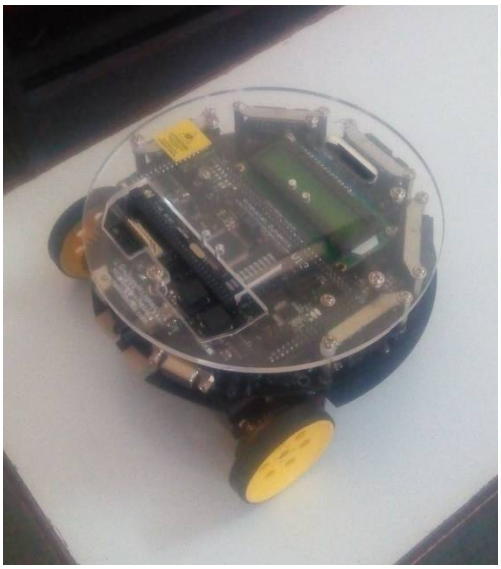

Fig. 2. Robotor

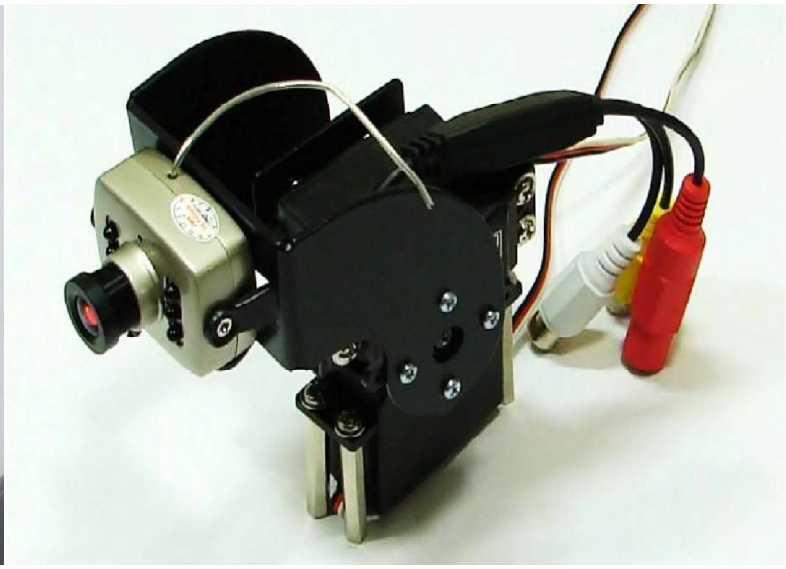

Fig. 3. Camera Pod

Only difference will be that instead connecting Audio-Video AV cable with the wireless receiver module, connect it directly to the wireless camera's Audio-Video AV out. Once video is acquired on the TV Tuner card's GUI, you are ready to acquire video on the Fire Bird V robot's GUI. All the GUIs of the Fire Bird V support live video display. For connections and driver installation refer to all the previous sections.

Fig. 4. Robotor with Camera Pod

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IV. FLOWCHART

Flow chart of An Autonomous Surveying Vehicle using Microcontroller 2560 is shown in fig. 5. The process described here starts with configuration of port b pins. As we need to use them as output pins for driving servo motors, 0xFF is written on the port. The all required ports are initialized. SFRs related to timer 1 are configured and initialized in 10 bit fast PWM mode. All peripherals with related interrupts are initialized. Required angles for rotation of servo motors are set in commands.

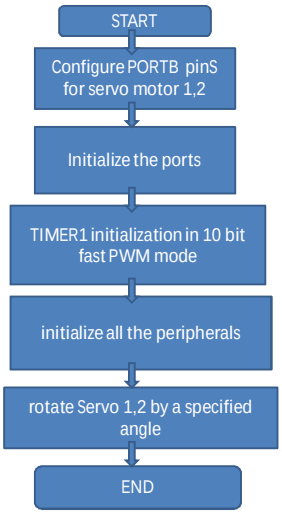

Fig. 5. Flowchart for Servo Motors

V. SIMULATION RESULTS

In GUI we can observe that video signals are coming from robotor. This robotor is placed in the area under surveillance. Robotor makes continuous locomotion around remote area. Camera will transmit video to commuter and continuous video monitoring is done without human being involved in the process

Fig. 6. Video display on the Fire Bird V robot's GUI

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VI. CONCLUSION AND FUTURE WORK

The implementation shows that the proposed robotor surveys the remote area with better quality of video transmission. The proposed robotor provides energy efficient way for video transmission and maximizes the lifetime of battery installed on robotor. As the performance of the proposed algorithm is analyzed on screen of computer in future with some modifications in design considerations the performance of the proposed algorithm can be compared with other exploration vehicles. We have used very small set of hardware, as size of are remote area increases the size of vehicle and intern complexity will increase. We can increase the number of robotor and analyze the performance.

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