

Real Time Video Black Box in Air Craft for an Intelligent Surveillance System

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Abstract

At present the scenario in air craft data acquisition system is only by audio recording with the help of FDR (Flight Data Recorder) and CVR (Cock Pit Voice Recorder) which is known as black box. This information is insufficient to know the happenings of before the crash. Hence, it is proposed to make the video recording of cock pit to improve the malfunction of system parameters of the air craft. This paper describes the method of analyzing the information of both audio and video of flight accidents recorded by the black box. The method of investigation of accidents can also be used efficiently for surface traffic signal system and ship monitoring.

Keywords: ARM Processor, Camera, Flow Code Software, Lab Centre Software, Video Recording, Wi-Fi Module

1. Introduction

Today's life, Everyone minds has to reach their destination of any place like nearer city or state or country or anywhere in the world as fast as the time save and can select travelling mode of such as bus, car, train and aero plane. People won't think how much they spending for travelling expenses, they have to reach their destination as soon as possible. So, on account of this already in all surface vehicle surveillance video camera and intelligent data recorder installed for safety and security purpose. So far this technology is not incorporated in flight. Only CVR/FDR are available. But, it is necessary as of any abnormalities situation happen^{1,3}.

The present attempt is the first of its kind where a device will be developed which will transmit data from the cockpit to the video black box as soon as it is receive and stored. The main feature of this work lies in recording and transmitting the data from the data recorder to the black box as if when it gets and there is no problem even when the data in the black box gets damaged during accident or erased by the pilot.

2. Existing System

Thanthry² expressed his view regarding safety and security mechanism of flight when any abnormal situation happen then immediate communication link between the aircraft and the ground station to control the flight. Even though it is good, but rare case video recording will give the clear picture what really happen inside at that situation. Therefore, in this paper it mainly deals video concept inclusion existing mechanism.

In another study of Lishwai³ analyzed the aviation safety to be mainly improving Knowledge of learning from accidents. The increasing demands for safety reinforce the industry to be more proactive in safety management. Improvements of safety can be further achieved by utilizing data collected during airlines' routine operations.

The data include hundreds to thousands of flight parameters recorded on board by the Flight Data Recorders (FDR). The current common practice is exceeded Detection, which triggers an alert when a parameter in the watch list exceeds a pre-defined thresh-

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old. Unknown issues remain latent as only known safety issues are examined.

Using data-mining techniques a method of evaluating flight data is developed to identify anomalous flights. It detects anomalies that are different from the majority by considering the multivariate time series of flight parameters without considering predefined parameters. The detected anomalies could help domain experts to identify latent patterns of emerging risks in flight operations.

By using sensors and actuators Mathews⁴ analyzes the one of the parameters of flight weight and angle to measure the quality assurance.

Dale Green written in his paper about the drawback of existing pinger and based on that he concludes the following points⁵:

- The penetration range to be Limited less than 1 Km
- In transmitted frequency the quality control was very Poor
- By ocean conditions the Pings are severely impacted
- Inference is more and Ambient noise is less

Wu, Jia and Li⁶ designed a video black box when the driver exceeds an acceleration of normal value, the black box start for recording and store it in the form of H.264 bit stream files whenever its required can used it for investigation purpose.

Even though it is good, but acceleration functions, it is not only a correct solution for recording. Sometimes other factors also come into the picture. Instead of H.264, AVS (Audio Video Standard) trans coding gives a high quality picture⁷ and if this mechanism is used in on board diagnosis to monitor the pilot performance⁹. With the a-

udio video communication link of ring topology is used⁸.

In all the above works, parameters relating to the flight are analyzed or video clipping analysis is done. With this communication, this paper describes both hardware and software. It also enables to get statistical analyzing the existing black box and the existing system of audio signals which are not sufficient enough for accident investigations. In this method, if analysis video & audio signals received in the new video black box will provide better and enough evidences for the investigative analysis which can be carried out after the incident of accident.

So, the proposed model will give the new deployment of motion pictures during the pathological situation in flight and with the statistical analysis the existing black box audio only not sufficient for accident investigation further and with the inclusion of implementing video technology will give the better solution for analysis.

3. Statistical Analysis

The Highlighted areas are flight accidents according to the survey during the year 2008 to 2013 shown in Table 1 and Figure 1 from this major accident due to bad weather and catching fire and minor accident due to engine failure and pilot error. These analysis leads to inferences which may be correct or not to get right. These are the issues some time can tackle at the instant itself. But some abnormal situation cannot predict it. For that the inclusion of video concept will give realistic idea and much more helpful for accident investigation.

Table 1. The highlighted areas are flight accidents according to the survey during the year 2008 to 2013

Year	Name of the Flight	Reason For Accident	Death	Alive
2008-Sep 14	<u>Aeroflot Flight 821</u>	Pilot error	88	0
2009-Aug 4	<u>Bangkok Airways Flight 266</u>	On landing crashes made due to bad weather	38	30
2010-Aug 16	<u>AIRES Flight 8250</u>	landing due to pilot error	2	113
2012- Apr 20	<u>Bhoja Air Flight 213</u>	Crashed due to bad weather	127	0
2013-Jan 29	<u>SCAT Airlines Flight 760</u>	Crashed due to thick fog	16	0

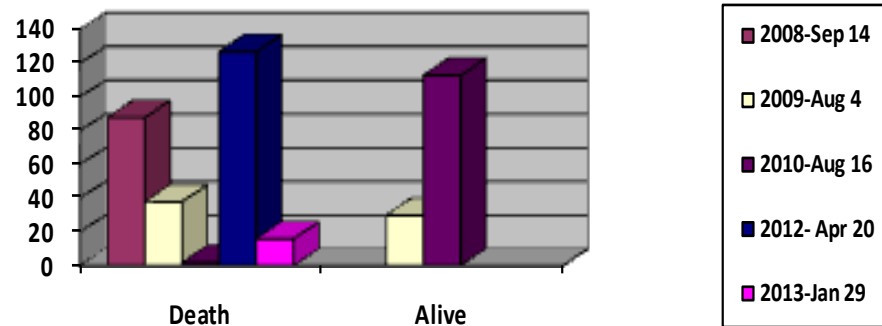


Figure 1. Flight accidents according to the survey during the year 2008 to 2013.

4. Proposed System

The proposed new technique is incorporated in the way of making audio and video recording in the cockpit for investigation purpose during the pathological situation. If flight is not taken off and if cockpit door is not closed the automatic video recording will not start. Automatic cockpit recording will take place once flight is taken off with the wheels folded and the cockpit door is at closed. There is no need to check the cockpit door status once the video recording is started. The video recording stops only when the wheels are landed on the surface till flight stop. This project is based on the ARM processor and the soft-

ware used is flow code and lab Centre.

4.1 Designing of the System Hardware

This research paper is based on the surveillance system and when abnormalities occur, the designed proto type system makes continuous recording and the same has been stored inside the existing black box.

The proposed system uses ARM7 as the master controller which controls the camera module, memory device, and WiFi module as shown in Figure 2 and Figure 3. This diagram is first simulated with Labcenter software and the coding is verified using FLOW CODE soft ware.

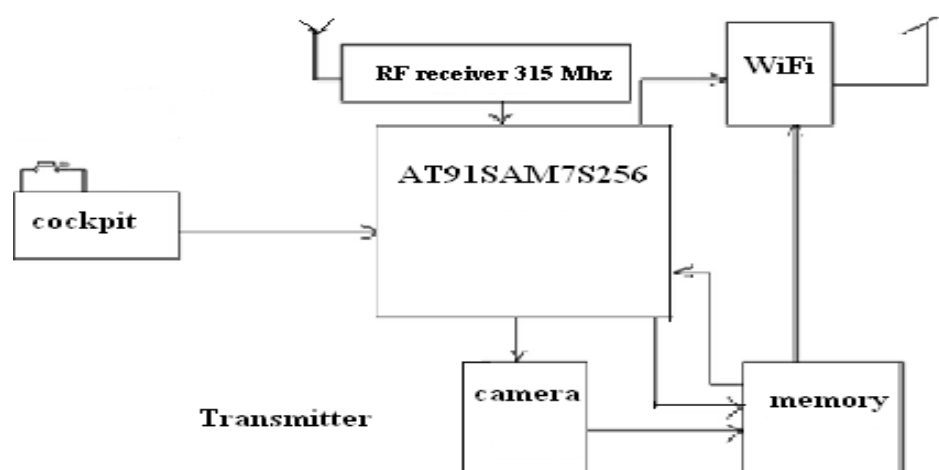


Figure 2. Transmitter block diagram..

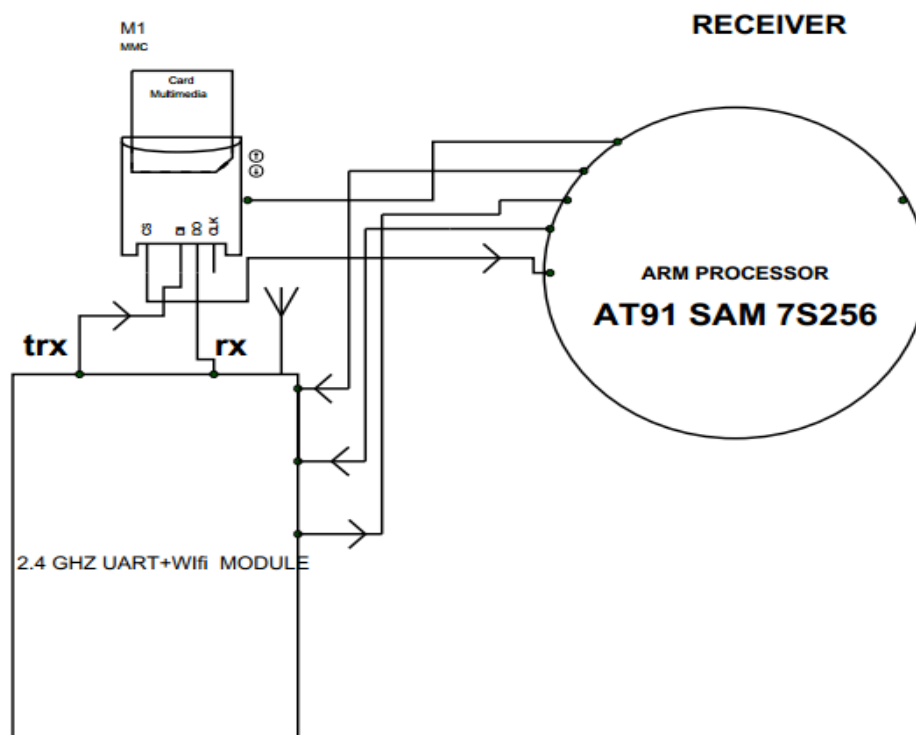


Figure 3. Receiver block diagram.

In cockpit, the camera is initiated whenever the flight is started and the process is carried out and motion information is stored in black box and is recycled every half an hour. The operation of the ARM7 processor is to initiate the camera and start for recording and storing information in black box. The recording information is carried out with help of wired communication to the end station.

4.2 Camera Module

STK1262B camera will give high resolution good quality of motion pictures. It made up of quad in line linear flat package which includes high precision image processor with DMA.

4.3 Information Storage Module

Flight video black box is a storage device which will collect various kinds of signal information through the camera sensor. The SD memory card stores all the information that it collects so it will be easy to read without complicate instruments.

4.4 Information Storage Module

The recorder information is communicated to the black box through Wi-Fi serial communication mode to the ARM processor serial port.

5. Processing Section

5.1 Information Processing Module

Compare to all processor ARM processor best suit for video concept. Because, it have the facility of IDE, compiler suite, debugger, simulator and JTAG development.

In this paper ARM7 (AT91SAM7S256) core processor was selected which will do the process of video capture, RF transmission and reception. The integration of hardware / software will give the correct solution of video capturing, recording and transmitting to the black box which met the needs of surveillance¹⁰.

The circuit of ARM7 microprocessor consists of following features:

- Thumb based 32 bit RISC Instruction

Table 2. Characteristis of ZigBee, WI-FI and Bluetooth.

	Wi-Fi	Zig Bee	Bluetooth
Range	50-100 meters	10-100 meters	10-100 meters
Networking Topology	Point to hub	Mesh or star ,peer to peer, Ad-hoc	Very small networks
Operating Frequency	2,4 and 5 GHz	2.4 GHz	2.4GHz
Typical Applications	Wireless LAN connectivity and internet access	Home Application, control and monitoring	Wireless connectivity between devices such as phones, laptops etc

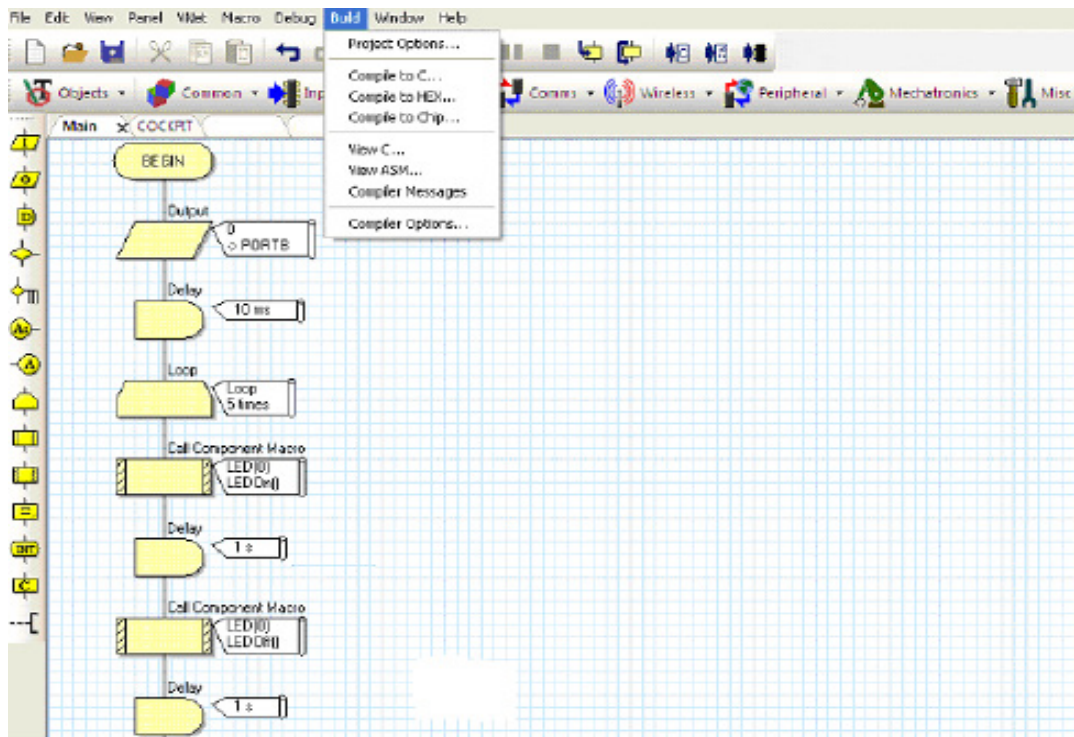
- 256 Kbytes internal high speed flash & 64 Kbytes high speed SRAM.
- Crystal oscillator frequency of 3 to 20 MHz
- Built in Boot loader programming
- Embedded ICE debug communication channel support
- Inbuilt JTAG debugging module which maintain IEEE 1149.1 standard

5.2 Design of the System Software

Prior designing of hardware the circuit is simulated in the lab centre software and the coding is written in flow code software.

5.2.1 Flow Code Software

Flow code software is a powerful language which resides flowcharts and macros is used design a controllers, LCD

**Figure 4.** The clear idea of flow code software usage.

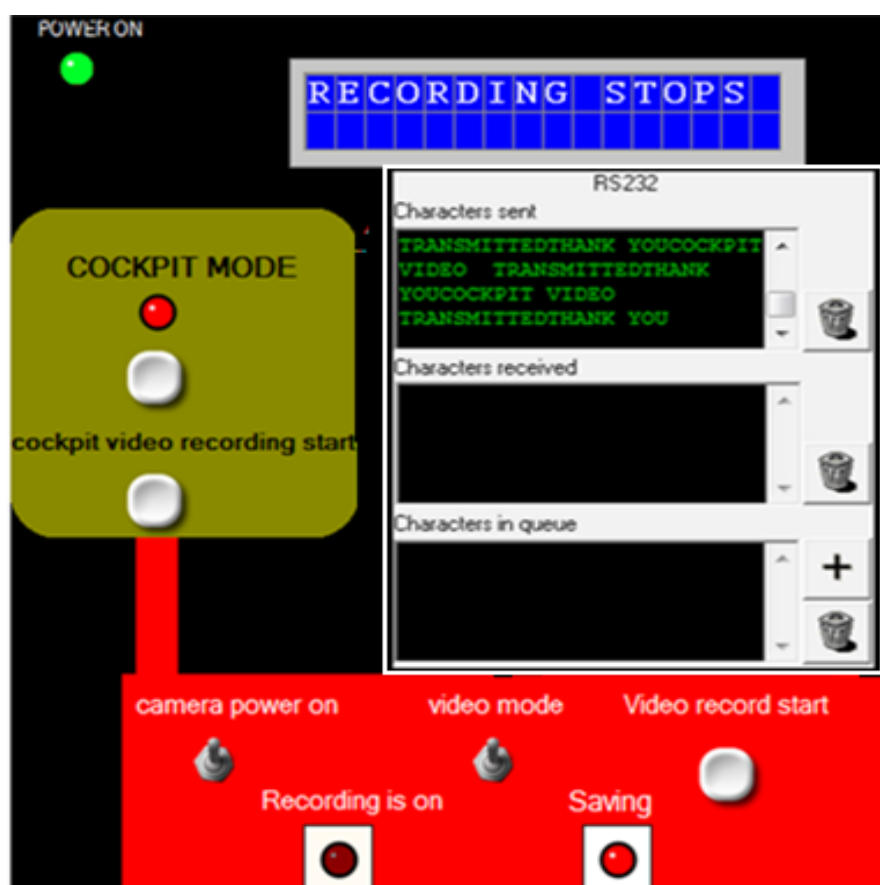


Figure 5. The clear idea of flow code software simulation output.

display, sensors, ADC and many others. The flow chart can be drawn by drag and drop system to complete a set of coding and able to run it smoothly as long as the settings are correct. It supports the PIC Micro, dsPIC, PIC24, AVR and ARM series of microcontroller and provides rapid system development. In this paper AT91SAM7S256 utilized as microcontroller and developed a flowchart using flow code and obtained HEX code to drive the hardware model. Figure 4 and Figure 5 shows the clear idea of flow code software usage and simulation output.

5.2.2 Lab Centre Software

It is software for virtual system modeling and PCB design that also equipped with a simulation p-spice schematic level before constructing a physical prototype in real time. It has the ability to simulate the microcontroller or micro-processor software program running on a target board connected to it. This software simulates input & output ports, interrupts, timers, USARTS & all other peripheral

present on each supported processor. Figure 6 and Figure 7 shows the clear idea of lab centre software usage.

6. Conclusion

Intelligent surveillance vehicle Tran's reception video black box is designed for air craft (Figure 8 and Figure 9) for the first time which activate acquisition data and interfaces to the processor to transmits the video. Further work has been planned to transmit lively to the base station during irregularities situation¹¹. This work is dedicated to all the people who have lost their life in various flight accidents. In future this same technique can be implemented in flight at the entrance to capture passenger full image for identification purpose who are travelled if accident happen and inside the flight if any intruder to threat the passenger that record information is used for investigation purpose.

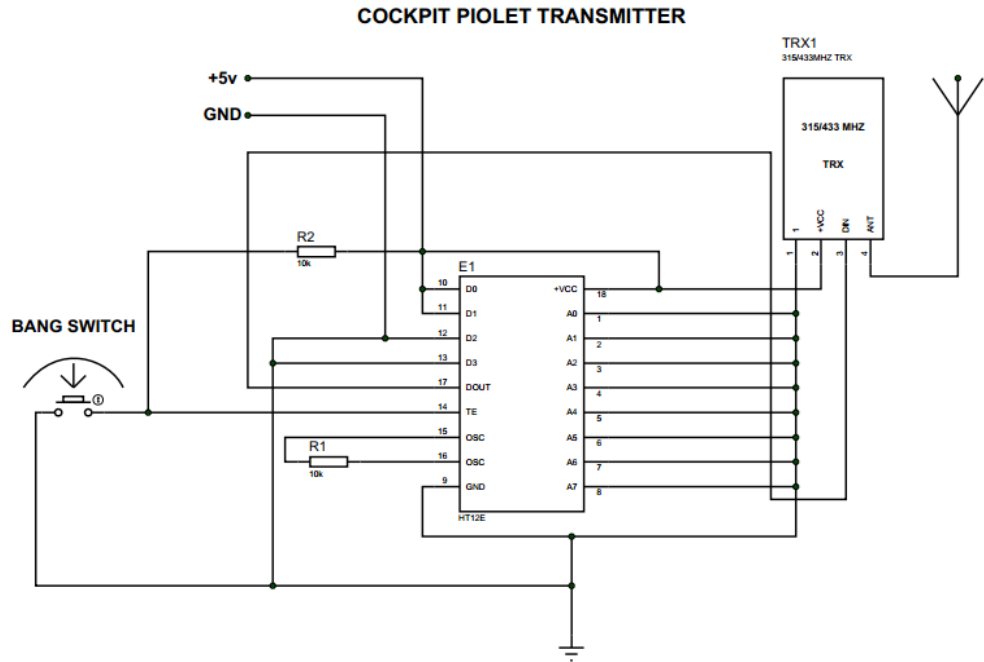


Figure 6. Cockpit transmitter..

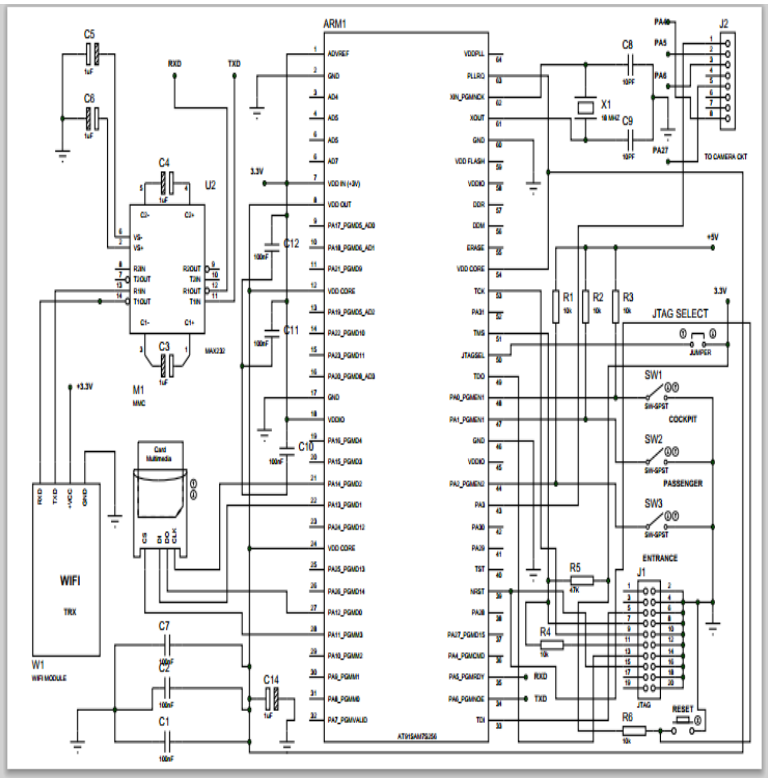


Figure 7. Schematic diagram.



Figure 8. Hardware circuit.

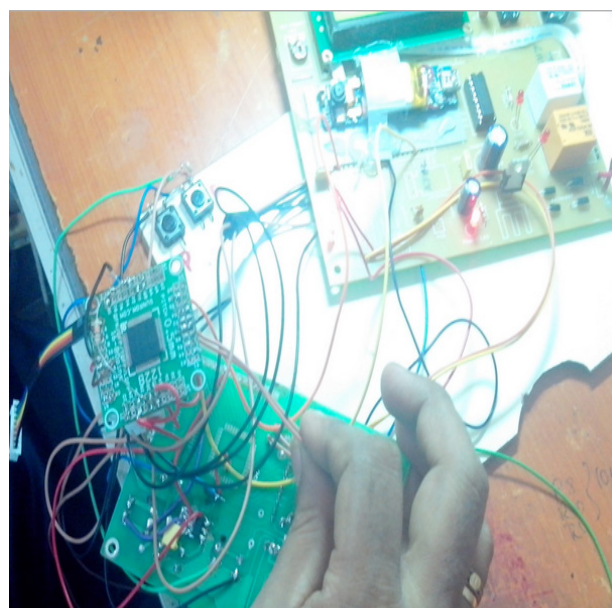


Figure 9. Hardware circuit.

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